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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

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Winter Spreads Its Blanket

Better Crops with PLANT FOOD

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Comparing . . . . . .

Mamma and Mammon

Jeff McDermid

HARVEST home festivals, Thanksgivings and holiday feasts, and the closer indoor living of wintertime bring to mind a somewhat neglected feature of modern life—the contribution made by the "gals" who manage our meals and run our domiciles. Back in 1940 reliable reports indicated that 70 per cent of the able-bodied female labor force were full-time homemakers, and 30 per cent were gainfully employed in various jobs outside the home, either full or part time. Estimates then given said that for every 100 persons of both sexes who were wage earners, 55 women were engaged only in the arts and crafts within the home.

In other words, almost 30 million folks of the gentler gender over 14 years old reported that their sole occupation was the daily doings in the household and the nursery, compared to nearly 54 million persons then listed as working for pay or seeking employment.

Since then we have had a few years of war turmoil with its upsetting of normal household arrangements, plus an era of very attractive wages and some labor scarcity here and there—so that prewar digits just referred to may not adequately show the situation as it exists today. But can we safely say in what direction the trend is going—toward a greater or a lesser emphasis upon the economic value of maintaining a full-time household queen on the domestic throne?

You can argue about this enhanced

income level in a couple of ways. You can reckon—and maybe prove—that higher monetary returns to the family enables it to buy and enjoy more goods and services which tend to reduce the burden of and the need for household tasks and home management. Then, again, your judgment and observation will tell you that when a hubby earns more jack it's just natural for the women-folks to rebel against climbing aboard the streetcar for regular daily employment.

But much more to the point, one should ask how many homes under almost any fair income level can afford to have Mamma go after Mammon and sacrifice her maternity. That could prove to be the most expensive of solutions.

IT'S a modern tendency to generalize by saying that the home of today is no longer a producing center, but is mainly a place for consumption. This same idea has visioned the farm, on the contrary, as a food production zone to the exclusion of victual consumption. Fortunately, neither of these hasty conjectures is true.

In the era of nation-building to which our ancestors belonged, farms and homes were independent, rugged establishments, where families produced what they consumed in food and raiment, or else they went without. What they went without often deprived them of health, long lives, and mental breadth, despite all the poetry and romance that have formed a mythical backdrop to the flail, the ox cart, the loom, and the spinning wheel.

I doubt very much if my pioneer Grandpa, if he could be awakened some bright winter morning to enjoy the electric range and furnace heat, would insist upon being reburied and resurrected to a land of flint-and-steel, smoky fireplaces, and frozen shirttails. I have a safe bet placed as well on the reaction of my Grandma, if she could get the milk man to deliver her butter instead of working a couple of hours over an old dash churn, or could push the bedside button instead of fumbling for the candle in the long night watches.

The dross and nonsense that have become mixed in these producer and consumer roles are astonishing. It was an ancient wheeze in the days of yore that he who did not produce raw materials was always completely rated as a consumer; and it followed that mankind fell into two broad groups—producers and parasites.

Of course, the home has always been a big center of consumption, yet its production aspect, although changed in volume and kind, is still a mighty potent force. The length of the home work week even today has been found to be far in excess of the traditional eight hours for five days which is often the index of industry. Studies have revealed that the homemaker spending full time on the job in the country regions works fully 60 hours weekly, and the urban counterpart is busy for about 50 hours.

Production for consumption and conservation purposes is still a major task for the woman in the home, whether she serves full time or works at it overtime when employed elsewhere. Farm homes serve three square meals a day and then some; and city workers expect Ma to have something extra-appetizing for the evening meal, for breakfasts, and on Sundays and holidays.

WHILE the primary raw materials and processing tasks do not concern the urban housewife, and to a diminishing degree the farm woman, there are enough irksome and particular duties left to earn for her the title of "producer." For if the everyday routine of the homemakers were to cease for a week or so all through this land, or if they struck for higher wages and more recognition from the "company," thousands of outside commercial activities would soon dwindle and fall apart. By comparison an oc-

casional bus or railway strike would seem tame.

Before the meals are ready to prepare, she must do her shopping. Before she does that, she who is wise and discriminating, and she who has a growing family, must have studied nutritional facts and geared them to the personal budget. Then she reads the ads and tramps down the aisles pushing her wire basket, peering about

and above for bargains that are good buys, with the purse and the proteins balanced.

Beyond that she must conserve the equipment of the household and maintain a neat and attractive dwelling, a job that takes more than a twist of the wrist and wishful thinking. She watches the clothes closets against moths and mildew, burnishes the dish ware and polishes the pots and pans, and spends the rest of the time —what there is of it—in child-rearing and being glamorous.

I presume we can credit the intelligent homemaker with some part of the remarkable advance in infant life span. In 1915 they say the infant death rate was over 100 out of each 1,000 live births. By 1930 this rate had fallen to 65, and in 1946 it had dropped to 37. If economic conditions were such as to make it unnecessary for so many women to work outside the home to keep up with high price levels, the oft-repeated horror tales about delinquent kids might be much reduced.

In the field of social reform and metaphysical research, however, it is unsafe to rely on economic causes alone. Human beings are very much different one from another. Some women who work all day outside the household raise better children than those who nag and nurse them all day long. I am going to dodge that issue. My worries are plenty without getting into a jam with readers.

Somebody has kindly pointed out to me that modern women who boss households do not have so much help these days from girls and grandmas. Even in the country, we are reminded, girls seek gainful jobs that remove them from home much sooner than was once the rule. Fewer three-generation families exist these days. Hence grandparents are not so common in our domiciles, either as aides or as extra providers or shall we say—burdens. Yet from personal observation and your own nod of approval, I make the claim that Mr. Man of the House has taken a bigger hand at the kitchen chores and the vacuum cleaning stunt in recent years. This is because he has more leisure to squander than his Dad had, and he no longer neighbors with the Indian chief whose proficiency in the art of "letting the squaw do it" was a too appealing example.

WHETHER the handy man around the house really lifts much of the wifely burden in the long run is perhaps a debatable issue; but it does at least give him a clearer picture of the sterling worth of a real homemaker and what she does in the line of production-for-use.

You may argue that household tasks have declined, but it is still a fact

(*Turn to page* 49)

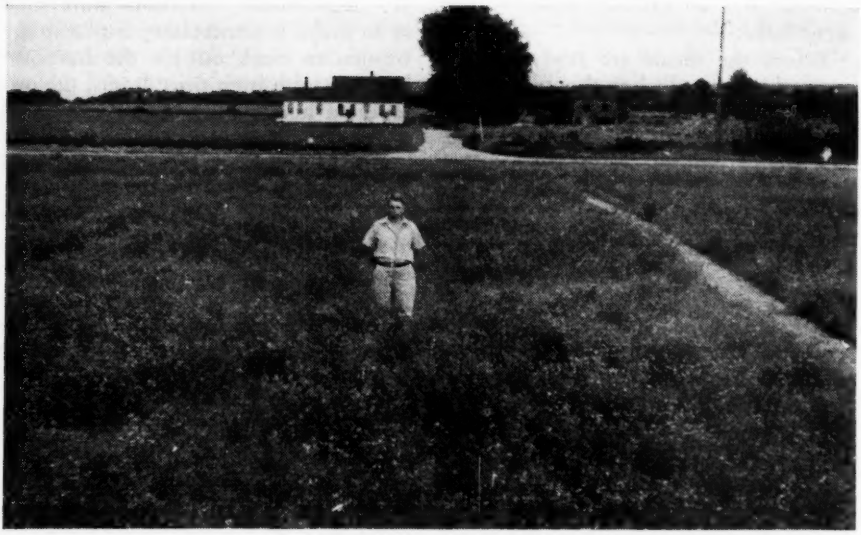

Fig. 1. Plot 119, July 17, 1944. Fertilizer 20 pounds N, 80 pounds P_2O_5, and 100 pounds K_2O annually. Good stand of legumes four years after seeding.

Better Hay with Potash

By T. E. Odland

Agricultural Experiment Station, Kingston, Rhode Island

THE high cost of purchased grain is constant worry of the New England dairyman. To make a reasonable profit he must seek every possible way of substituting high-quality roughage for as much of the grain as possible. This roughage may be in the form of good pasture, silage, or high-quality hay. The most successful dairymen make use of all three possibilities.

The Experiment Stations in the region have done a great deal of work on the problems of helping the milk producer in improving his pastures, making more silage, and in producing more and better hay. Considerable progress has been made along all these lines. The Rhode Island Experiment Station has been especially interested in research on the fertilizer requirements of various hay crops. Many different fertilizer ratios with various amounts of nitrogen, phosphoric acid, and potash have been used. It has been found that fertilizers can be used to advantage not only to increase the yields but to improve the quality of the crop by maintaining the stands of legumes longer. The legumes furnish the protein that is so essential in dairy feeding.

Alfalfa is the number one hay legume when it can be grown successfully. Success in growing alfalfa means getting a good stand and also maintaining that stand for a number of years. When a grower goes to the expense of

getting his land in the best condition for growing the crop and in addition has invested in the labor and cash necessary to get the seed planted, he does not desire to repeat this every other year. He wants to leave his alfalfa field for hay for at least 4 or 5 years if possible. This is good, sound practice.

One of the aims of the experimental work at the Rhode Island Station has been to develop a liming and fertilizing program for mixed legume-grass hay that will maintain the legumes over as long a period as possible. This is especially true of the alfalfa in the mixture. If practices that will enable the dairyman to maintain good stands of alfalfa either alone or in mixtures for even 4 or 5 years can be established, it will mean that a great deal more alfalfa will be grown in the Northeastern States.

An experiment begun at the Rhode Island Experiment Station more than 30 years ago has produced information that seems to point the way on how to maintain alfalfa stands over a period of years. As originally planned, this experiment had for its purpose the comparsion of various potash sources for use in fertilizer mixtures. The sources compared included muriate of potash, sulfate of potash, kainit, and sulfate of potash-magnesia (double manure salts). Different levels of potash application were also included. Many different crops were grown on the plots in this experiment. A rotation of two years of cultivated crops was followed by two years of sod crops. The results obtained in this experiment can be found in a number of published bulletins and research papers (Rhode Island Agricultural Experiment Station Bulletin No. 280 and others).

One of the plots in this experiment (119) received what was considered an optimum amount of potash for the crops grown, while another plot (116) received no potash for a number of years. This was later changed to a small amount since so many crops failed when no potash was applied. No single source of potash proved superior for all crops or for any one crop every year.

A hay mixture, largely legumes, was grown on these plots in 1924 and 1925. The high-potash plot averaged 4.26 tons per acre, while the low-potash plot produced only 1.34 tons per acre. In other sod crop years only grasses were grown. The differences in yield were not so

Fig. 2. Plot 117, July 17, 1944. Fertilizer 20 pounds N, 80 pounds P_2O_5, and 50 pounds K_2O annually. Poor stand of legumes.

great between the low- and high-potash plots when grasses alone were grown as when the legume-grass mixture was used.

In order to study the effect of various amounts of potash on the longevity of stands of legumes and grasses, the rotation was changed in 1941 so that the plots would remain in sod for a number of years. A legume-grass mixture consisting of alfalfa, red and alsike clover, timothy, and redtop was planted in April. The seeding mixture consisted of the following in pounds per acre:

Grimm Alfalfa	7
Medium Red Clover	5
Alsike Clover	3
Timothy	3
Redtop	2

Each year stands of legumes and grass in the hay crop were estimated and yields determined. In Table I the yields and percentages of legumes and grasses are shown for the plots where the nitrogen and phosphoric acid contents of the fertilizers were varied. Potash was applied uniformly in the form of muriate and at a rate of 100 pounds K_2O per acre. Nitrogen varied from 5 to 20 pounds N and phosphoric acid from 20 to 80 pounds P_2O_5 per acre.

The results show that the amount of nitrogen applied had little effect on either the yields or composition of the hay. The amount of nitrogen applied was small in all cases. It was purposely kept low in order to maintain as high a percentage of legumes in the mixture as possible.

Likewise, varying the annual application of phosphoric acid from 20 to 80 pounds per acre made little difference in yields or composition of the hay crops. It should be kept in mind that these plots had received liberal applications of phosphorus in the fertilizer in previous years. Other experiments have shown that with heavy applications of phosphorus over a number of years, a concentration of this element may be built up in the soil so that some crops may get along very well for a few years at least with the stored phosphorus. This is probably what happened here. Soil tests showed all these plots to have medium to high soil phosphorus.

The results obtained on the plots where the amount of potash was varied are shown in Table II.

These plots show a big variation in yield and also in the composition of the hay. On plot 116 where only small amounts of potash had been applied for many years the average yield for the 5-year period was only 1.17 tons per acre. The average legume content was only 2 per cent. The yield on plot 114 which received 100 pounds of potash

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TABLE I.—THE EFFECT OF VARYING AMOUNTS OF NITROGEN AND PHOSPHORUS ON THE YIELD AND AVERAGE ESTIMATED COMPOSITION OF LEGUME-GRASS HAY, 1941-1945, INCLUSIVE.

Plot	Treatment N–P_2O_5–K_2O	Yield in Tons per Acre*						Average Per Cent	
		1941	1942	1943	1944	1945	Average	Legumes	Grasses
123	10–80–100	3.87	3.58	4.18	3.71	3.40	3.75	74	26
127	10–80–100	3.44	3.35	3.55	3.02	3.29	3.33	65	35
121	5–80–100	3.74	3.32	3.36	2.81	4.08	3.46	62	38
125	5–80–100	3.55	3.20	3.82	3.16	3.41	3.43	73	27
122	20–40–100	4.04	3.18	3.99	3.05	3.78	3.61	60	40
126	20–40–100	4.11	3.53	3.68	3.19	4.02	3.71	63	37
120	20–20–100	3.21	3.65	3.79	2.72	4.13	3.50	59	41
124	20–20–100	4.15	3.40	4.05	3.29	3.26	3.63	74	26

* 15% Moisture basis.

Fig. 1. Ladino clover and orchard grass are well adapted to the Piedmont and Mountain counties of North Carolina.

Ladino Clover—Italian Gift to North Carolina Pastures

By Roy L. Lovvorn

Agronomy Department, North Carolina State College, Raleigh, North Carolina

LADINO clover is the greatest forage crop to hit North Carolina since the introduction of the annual lespedezas in the middle twenties, and its spread over the State has been much more rapid than that of lespedeza. This clover is now being grown in every county; and although no data are available as to the total acreage, it is probably at least 100,000 acres. All of this has been accomplished within the past few years and most of the rapid increase has been within the past three years.

Ladino seems to be well adapted to North Carolina conditions since we do not have the winter injury of the North nor the summer injury of the deep South. It is now growing on most of the soils of the State. Our experiments have demonstrated that it is more productive, grows more uniformly throughout the season, is drought tolerant, and recovers faster following a temporary drought than common white clover. Unlike white clover, Ladino production has been dependable from year to year during the short time it has been grown.

Although spring seedings are possible, fall seedings are more successful and result in grazing the following spring, often by April 1. Seedings made

Fig. 2. Ladino clover and tall fescue on the Animal Husbandry Farm of the North Carolina State College. This area was grazed until December 22 in 1947.

in September 1947 had produced nearly one ton of forage per acre by April 15, 1948. Grazing can begin in March on established stands. E. W. Faires obtained approximately 200 cow-grazing days or the total digestible nutrients of 70 bushels of corn at the Coastal Plain Station, Willard, during 1947 from a Ladino clover-Dallis grass pasture as compared to only one half that yield from a similarly treated pasture in which the Ladino was omitted.

In another experiment on the State College farm last year Ladino clover and tall fescue were grazed until December 22. This late grazing was accomplished, however, by removing the cattle during the late summer and allowing the clover and grass to accumulate. In this experiment, conducted in cooperation with Professors E. H. Hostetler and J. C. Pierce of the Animal Industry Department, the same paddock produced 70 pounds of beef per acre between April 20 and May 18, 1948.

Ladino clover has revolutionized our pasture fertilization program. Former recommendations of 300 pounds of 0-14-7 annually are no longer adequate. For maximum performance the crop must be fertilized like alfalfa because its nutrient removal is equal to alfalfa as is shown in Table I.

Extensive studies in which the nutritional requirements of Ladino clover are being studied along with those of alfalfa and big trefoil are now under way. In the meantime 1 to 2 tons of lime and 800 to 1,000 pounds of 2-12-12 fertilizer are being used at seeding, followed by annual applications of 300 to 500 pounds of 0-9-27, 0-10-20, or 0-12-12.

Standard companion grasses in North Carolina have been orchard for the western half of the State and Dallis grass for the eastern half. Orchard grass and Ladino clover grow well to-

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TABLE I.—NUTRIENT REMOVAL FIRST YEAR AFTER SEEDING

	Pounds per Acre			
	N	P_2O_5	K_2O	CaO
Ladino...	131.2	28.4	117.2	67.0
Alfalfa...	149.8	28.9	99.5	77.8

Crop Logging Sugar Cane in Hawaii

By Harry F. Clements

Hawaii Agricultural Experiment Station, Honolulu, Hawaii

THE program of crop logging sugar cane, as now practiced in Hawaii, is based on fundamental researches begun about 10 years ago by the author and his staff at the University of Hawaii Agricultural Experiment Station. In simplest terms, the crop log is a graphic record of the crop's progress and is made up of a series of chemical and physical measurements and observations which indicate the "health" of the crop and the changes in management necessary to produce maximum yields. In this sense it is a dynamic approach to crop production.

In Hawaii, more so perhaps than elsewhere, crops within a comparatively small area are grown in a wide variety of climates and soils. To determine the relative effects of each, an experiment was undertaken in which the same variety of sugar cane was grown in two locations on the island of Oahu, about 17 air miles apart. At one place, Waipio, the sunlight is relatively intense, the days dry and warm. Heavy irrigation is required. At the other place, Kailua, the sky is frequently overcast, mountains nearby cast early afternoon shadows over the area, and rainfall is sufficiently abundant to provide adequate moisture. At both places fertilizers are required and were provided.

The yields of cane and sugar from the two areas were widely different and seemed to be in proportion to the sunlight available to each area. To eliminate the soil as a factor accounting for the differences in cane yield, soil from the Kailua plots was taken to Waipio and there placed in large concrete pots. These pots were interspaced with other pots filled with soil taken from the Waipio plots. Both sets were fertilized equally and cane plants were planted. When the plants were about five feet tall, the test was discontinued. At this time there was no significant difference in size favoring the Waipio soil. Actually what small differences occurred favored the plants in the Kailua soil. It is clear, therefore, that soil differences did not account for the differences in crop production at the two locations. The moisture differences, as determined by tissue analysis, were nil. Even temperature differences were small. The significant differences lay in the solar radiation and its absorption.

Since production is largely influenced by atmospheric conditions and since the "average weather year" is indeed a rarity, it appears logical to conclude that the moisture, fertilizer, and general cultural requirements will not be the same for any two crops grown on the same field, nor for those grown the same year at some distance apart.

This concept applied to soils of different chemical and physical characteristics further complicates the problem for the crop producer. A heavy crop in general requires more of particular soil elements than a light crop. Furthermore, at one stage in the production of a given crop, the amount of chemical elements required is very much greater than in others. For ex-

ample, potassium is required in large amounts during the so-called boom stage of sugar cane growth. This is the period of heaviest drainage on the soil supply. Thus, even though chemical analysis may show soils to be equal in replaceable potassium, it gives no indication of the relative ability of the two soils to maintain an available supply against heavy requirements at a particular time in the life of a crop.

The chemical characteristics are only one part of the soil complex affecting the crop. The other and perhaps the more important is the physical character of the soil, for it is this characteristic which largely is responsible for limiting the root development of the crop. The volume of soil into which a plant can insert its roots is perhaps more nearly related to total amounts of material absorbed than is the chemical composition of the soil itself.

After considering these points, it is understandable that soil analysis has not been especially useful in determining fertilizer requirements of sugar cane.

Mitscherlich pot testing, likewise, has not been very helpful. Taking a small volume of soil from its place in the field to a hothouse at some distance under entirely different climatic conditions and growing in that disturbed and limited volume, a plant thought to be an indicator plant has not yielded results which can be applied with any degree of precision to cane growing in the field under the wide variety of weather conditions extant in the territory.

Even replicated field experiments have limited usefulness unless some diagnostic means is developed to transfer findings to new situations. Unless such means are found, experiments yield results of historical value only. When a two-year cane crop is produced and the experiments are harvested at considerable cost of time and money, the results indicate what the best practice was for that particular crop. Unless there is some objective means of relating the results of the experiment to a condition which existed in that crop and of transferring this information to the field across the road or even the crop to follow on the same field, the grower has but one course open—that is to conduct more and more experiments year after year and then abide by a vague sort of generalization. Precision is out of the question.

Similarly, analysis of foliar tissues for N, P, and K are not in themselves adequate for diagnosis of the condition of the crop, since it has not been possible with these data alone to predict with any degree of certainty the performance of a crop. In fact, results of experiments dealing with foliar analysis have to await yield data before complete interpretation is possible.

It was against this historical background that the research was undertaken which led to the development of the crop log program. There were several objectives of the program. First, it was essential to determine the tissue of the cane plant which would best serve as an index for the various chemical constituents normally required by the plant—nitrogen, potassium, phosphorus, calcium, and magnesium. Furthermore, it was necessary to determine what constituted adequate levels for each of these, singly and in relation to one another. Second, it was necessary to determine the index tissue for water and to determine the relationships of this index to the growth of the plant and to the levels of the various chemical constituents. It is curious that more attention has not been given in the past to tissue moisture, for this material making up the dominant part of the plant indeed largely determines the levels and the effectiveness of the elements absorbed. Third, it was necessary to work out an index which was a measure of the vigor or growth potential of the plant. Finally, it was necessary to find some index of the fitness of the plant to its environment. Although the research phases are still far from complete, enough progress has

been made to apply the knowledge so far gained to commercial sugar production. At the present time all the fields on four Hawaiian sugar plantations of about 52,000 acres are being logged.

Selecting the Proper Index Tissue

Data used for the selection of the proper index tissues were collected from 24 crops of sugar cane. These crops included two varieties which were planted in two totally different areas and which were started at four different times of the year. As soon as each crop was large enough to be sampled (2 to 3 months) five shoots representing the average of the main stand were taken from each crop at intervals of 35 days until harvest, when the crop is two years old. These shoots consisted of the green tops and all of the stem down to the soil line. They were disassembled by severing the green tops from the stem at the node carrying the oldest green leaf. The stem was cut into three internode pieces starting at the base and working upwards. The green top was divided as follows: The leaves were numbered from top down; that is, the newest leaf just emerging from the growing cluster was called number one. The leaves starting with number seven and going downward to the first dead leaf were removed from the plant; these were separated into sheaths and blades. These are the oldest sheaths and the oldest blades and were so labeled. The stem which supported these leaves was next removed and treated as a single sample. Leaves three to six inclusive, representing the youngest fully developed organs, were next separated from the stem and also divided into sheaths and blades and were called young sheaths and young blades, respectively. The stem which supported these organs is still in the stage of elongative and circumferential expansion and was called the elongating cane at whose tip was the stem meristem. The remaining leaves, one and two, and the enclosed embryonic leaves were included in a single sample and were called the spindle cluster.

Green weights of all these parts were obtained and then the material was chopped into small pieces and dried in a strongly ventilated oven at 90°C. until dry. Dry weights were taken, and the material was then ground in a Wiley mill and stored for analysis. Where necessary, a second drying was effected before an analysis was made.

All these samples for all the crops were analyzed for moisture, total sugars, total nitrogen, potassium, phosphorus, calcium, and magnesium. In all, well over 100,000 analyses were made. With this mass of data it was possible to select the best index tissue for each of the materials worked with.

The index tissue must be a precise tissue so that anyone following directions can get reproducible results. At once, then, we limit the choice to the sheath samples, the blade samples, and the spindle cluster.

Furthermore, the level of the particular constituent in the index tissue must reflect the levels in all the other parts of the plant—the meristematic material, the elongating tissues, the green tissues, and the stem tissues. In order to establish these points, it was only necessary to use the statistical method of linear regression.

The young leaf sheaths were chosen as the index tissue for total sugars (the primary index, discussed later), moisture, and all of the ash constituents. The green photosynthetic tissue of the middle third of the young blades was chosen as the index tissue for nitrogen. As time went on, it became apparent that the green weight of the young sheath sample served as an index for the general vigor of the plant.

Adequate Levels for Each of the Materials Needed by the Crop

After having selected the correct index tissue, it was next necessary to determine the meaning of each level of material, what the lowest adequate

TABLE I

Hawi 1 Experiment*

Plots	Pounds per Acre K_2O Applied	K Index	Tons Cane per Acre	Tons Sugar per Acre
K_0	0	.99	34.94	5.29
K_1	75	2.17	46.93	7.25
K_2	150	2.69	57.23	8.89

Halawa 5 Experiment**

Plots	Pounds per Acre K_2O Applied	K Index	Tons Cane per Acre	Tons Sugar per Acre
K_0	0	1.78	60.95	9.42
K_1	75	2.47	73.07	10.74
K_2	150	2.78	75.75	10.66

* All differences are significant beyond the 1 per cent level.
** Differences between K_1 and K_2 plots are not significant.

level was, and the effects of successive levels of each of the manageable materials used in crop production. The methods used were of three general kinds. The first may be called simple deduction. Where the crop log was maintained for an especially successful series of crops on a particular field, it was logical to deduce that the levels of the several materials were at least adequate. The second method was observational in character. Again using the crop log and closely observing two or more fields, one of which was obviously in distress while others were doing well, it was not difficult to determine the cause of the poorer performance. The third method was that of field experimentation. Where a deficiency was suspected, field experiments were set up with differential applications of the material associating the crop log with these plots. Potassium may be used as an illustration. On one of the plantations, crop logs continued to show the potassium index at very low levels. Here, then, was an opportunity to install replicated field experiments with different increments of a potash fertilizer added. Samples were taken to determine the potassium index for each of the plots. Close observation was maintained throughout the crop and in some cases the crop was harvested so as to obtain final weights. Usually where the crop log showed a very low level, it was not necessary to harvest the crop, for it was very apparent that the differences in growth were huge.

Two experiments at Kohala Sugar Company are chosen to illustrate the method. Although the actual experiments were factorial, involving both potash and phosphate fertilizer, only the potash results will be shown here. The plots were strips of cane line 27 feet long and were replicated 12 times. One set of plots received no potash fertilizer (K_0), one set 75 pounds K_2O (K_1) and one set 150 pounds (K_2). Three sheath samples were taken from each plot at intervals of 35 days during the middle of the crop. At the end of the crop, the cane was harvested. The results are given in Table I.

It is apparent that where the K index was below 2.25 yields were significantly lower than where the K index was above this point.

One advantage of this method over

ordinary field experimentation without crop logging is that where large variations occur, particularly where the variations are caused by reserve amounts of the material being tested, the index from plot to plot reflects such variation. Occasionally it is better to use the statistical method of linear regression than the method of variance analysis to determine significance of experimental results.

The actual level of the K index adopted was arrived at from several points of view. Where a series of crops from a field which received no potash fertilizer gave consistently excellent yields, the K index of that crop was regarded as at least adequate.

Many experiments such as the two reported narrowed the possibilities to this approximate level of 2.25. But in addition to this, the individual plot yields with the corresponding K indices were plotted, a curvilinear regression equation obtained, and the resulting curve, when plotted, verified the level decided upon.

After many such experiments, it became apparent that where the potash index was at 2.25 or above before the experiment was installed, no response was obtained by the addition of potash fertilizer. Where the level was below 2.25 there was always a response and this in proportion to the distance the level was from the normal line. Here, then, an experiment was conducted and a method of transferring the results from the experiment to other fields was applied. After a sufficient number of such experiments and experiences, it is no longer necessary to conduct labor-consuming experiments in field after field.

Crop Log Routine

Each field is sampled every 35 days. Sampling of cane plants is started as shortly after sunup as possible and continues for not more than 2½ hours. This is necessary to avoid influences of the particular day. Five cane tops are removed from scattered parts of the area. Each top is taken as representative of the plants about it. The size of each area is determined by its uniformity. At times whole fields of more than 200 acres constitute a single sampling area. At other times even a small field may be subdivided into several areas. Five cane tops constitute one sample. On a single morning anywhere up to eight fields are sampled by one man provided with a car. The samples are kept clean and are taken to the plantation laboratory. Here they are taken apart and leaves Nos. 3, 4, 5, and 6 are removed from the stem. All other material is discarded. The blades are separated from the sheaths. The four sheaths from each of five stalks make up a single sample. The green weight of this material is obtained. This value, besides being the base for the moisture calculations, has been found to be a reliable index to the general vigor or growth potential of the plant and is characteristic of the particular variety. The sheath material is chopped into ½-inch lengths and placed in a strongly ventilated drier heated to 90°C. After three hours of drying, the dry material is weighed, ground in a Wiley mill, and stored for the following analyses: total sugars, potassium, phosphorus, calcium, and magnesium.

The middle tissue of the young green blades after separation from the sheaths is cut out and the midribs stripped out. The green tissue is dried, ground, and stored for nitrogen analysis.

Methods of analysis used are standard methods, adopted to mass production procedure. Any compromise with accuracy will yield totally unsatisfactory results. However, all the reliable methods lend themselves well to mass production methods if adequate equipment is provided.

Three large plantations in the territory send their samples to a central laboratory where two trained chemists are able to do all the analytical work resulting from crop logging about 32,000 acres of cane.

The Crop Log

A crop log is shown on page 17. In practice, the form sheet is a semi-transparent sheet of coordinate paper 11″ by 16″. The guide lines and formal designations are printed.

Temperature and Sunlight. At the top of the log, average daily day-degrees for the 35-day period are shown. (The day-degree has been in use in the Island sugar industry and is defined as the number of degrees the daily maximum temperature exceeds 70°F.) Where sunlight readings are available the average total daily gram calories/cm² for the 35-day interval is shown, reading off the right hand legend.

Elongation and Growth Potential Records. The record of growth made (average elongation of stalks in inches per day for the 35-day interval) and the growth potential or vigor index (the green weight of the sheaths of leaves 3, 4, 5, and 6 per stalk) are shown in the next space on the log. The actual accumulated growth in feet made by the cane is shown at the top of the space. The vigor index is far from being entirely satisfactory, but is very helpful. Obviously, the values are different for each variety. When some means is developed for simple assaying of those substances directly related to growth, such a value will be more useful as a vigor index.

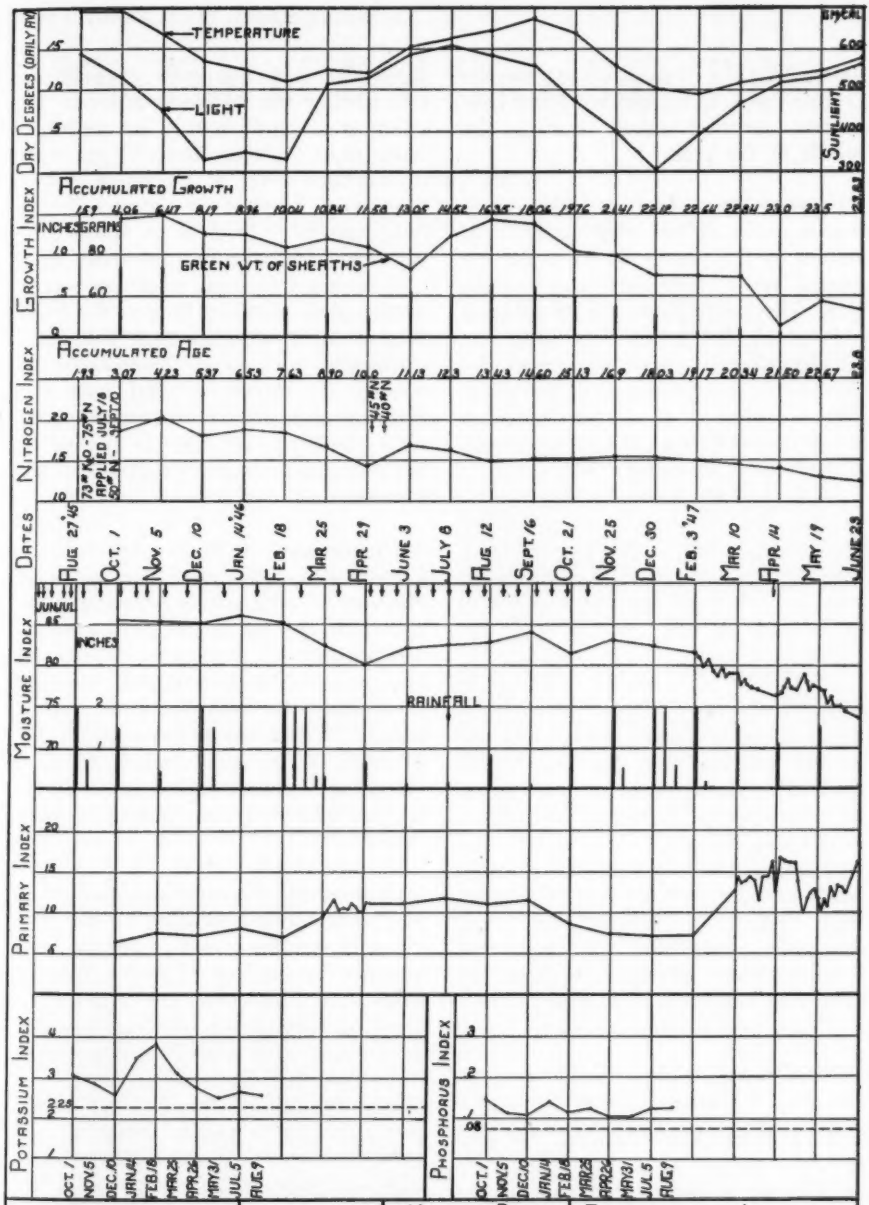
The Nitrogen Index and Age. The total nitrogen content of the green tissue of the young blades expressed as per cent of the dry weight is shown in the next space. The desired level is somewhat characteristic of the variety but more dominantly characteristic of the prevailing temperature and elevation of the field. The colder the area, the higher is the normal nitrogen level. In general, within a crop the nitrogen level is high during the early phases and gradually drops off toward maturity.

Dates of sample taking are shown at the bottom of the nitrogen space. The accumulating age of the crop is shown at the top of the space. Inserted at various dates are the amounts and kinds of fertilizer applied.

The Moisture Index. In the space below the nitrogen index is shown the moisture index—the percentage of water in the fresh young sheath tissue. The downward pointing arrows indicate dates of irrigation. The vertical bars represent rainfall for each 35-day period. The moisture index for entirely satisfactory crops must be held at or above 85 per cent for the first 6 or 8 months, preferably at 80 to 82 per cent for the remainder of the period until ripening time 5 to 7 months before harvest during which time the level should gradually approach 73 to 75 per cent.

The Primary Index. The total sugar content of the sheath tissue, expressed on a dry weight basis, is a measure of the fitness of the cane plant to its energy environment and is shown in the space below the moisture index space. When the growth of the plant tends to exceed the energy available to the crop, the sugar level is low, as it should be during the early part of the crop. During the middle of the crop, the primary index should be near normal (10 per cent), and during the ripening phase should rise well above the normal level. Because it reflects the fitness of the plant to its environment, it is regarded as the most important of all the indices and hence is called the primary index.

The Potassium Index. The potassium index is the potassium content of the young sheath tissues expressed on the basis of the sugar-free dry weight. Levels maintained above the 2.25 level are adequate for the heaviest crops produced. Crops, especially ratoon crops, whose levels are low, show responses to increased potash applica-



CROP YEAR - 1947 FIELD - RB ACRES - CYCLE - 1ST RATOON VAR. - 32-8560 ELEV. - SOIL TYPE - RESIDUAL M. E. RANGE - 35-37	STARTED - JUNE 29 '45 STAND (6 MOS) HARVESTED - JUNE 24 '47 AGE - 23.8 TRASH % DEAD CANE %	**Harvest Data** TC/A - 120.00 BRIX - 21.0 TS/A - 15.58 POL - 18.7 TC/TS - 7.70 PURITY - 89.7 TCPRM - 5.05 TSPRM - 0.656	**Fertilization and Irrigation** PLAN #N #P_2O_5 #K_2O ACTUAL - 210 #N 0 #P_2O_5 73 #K_2O AGE AT 1ST N - 0.63 MOS. AGE AT LAST N - 10.50 MOS. DATE 1ST IRRIG - 0.20 MOS. 7/3 TOTAL NO ROUNDS - 3/ T. RAIN - 31.58

tions. Usually, it is necessary to determine the K index on only three consecutive samples taken during the middle of the crop.

Phosphorus Index. The phosphorus index is the total phosphorus content of the young sheath tissue expressed on a sugar-free dry weight basis. The normal level is now assumed to be somewhat lower than .080.

Calcium and magnesium are also plotted in spaces provided for phosphorus—although the actual meaning of the various levels has not as yet been adequately worked out.

At the bottom of the crop log, spaces are provided for various miscellaneous data which make it complete. After the crop is completed, the crop log may be white-printed for additional copies and for filing.

The Use of the Crop Log

The crop log has three main functions. First, it is used to determine the current needs of the crop growing in the field. These needs apply to water and fertilizer requirements as well as to ripening the crop. Second, the crop logs are source material for research work and for initiation of new practices. Third, the crop logs for several successive crops from the same field form a record of trends within that field over long periods of time. These will now be presented in order.

The Crop Log as a Guide to the Current Crop

The First Six Months. In general, the success of a sugar cane crop in Hawaii is determined during the first six months of its life. Because sampling does not begin until the crop is about two months old, experience gathered from previous logs on the same field or area dictates certain practices for the start of new crops. Furthermore, it is desirable from the point of view of large-scale operations to routinize as many of them as possible. We have learned that a crop should come onto the log with its primary index below the 10 per cent level. In order to accomplish this, its moisture index must be at or above 85 per cent, its nitrogen level at or above 2 per cent, its K level at or above 2.25 per cent, and its P level at or above 0.80 per cent. In order to accomplish this, it is necessary to apply whatever potash or phosphate is called for (on the basis of previous logs on the same field) immediately. That is, phosphates if needed are usually applied with the planting material. Furthermore, sufficient phosphate fertilizer is applied to the plant crop to satisfy any successive ratoons.

Potassium. Unless the field is known from previous logs of plant crops to be deficient in potassium, applications are not made until samples are taken from the current crop. If, however, potash is required, it is applied after the crop has fully germinated. Where the amount called for is small, all of it is applied at once. Where the amount called for is large, the application is made in two or more doses.

Nitrogen. The application of nitrogen to the crop is routine for the first 10 to 12 months except in certain cases revealed by the log. Usually 20 to 40 pounds of nitrogen are applied at planting time, if the planting machine is provided with a fertilizer attachment and hence the fertilizer is buried. The function of this nitrogen is to stimulate germination and to invigorate the growth of the germinating shoots.

When germination is about complete (6 to 8 weeks after planting) the first surface application of fertilizer is made directly on the cane line. The function of this application is not only to force growth of the primary shoots, but also to force the development of buds at the base of the primaries. These become the secondary shoots and add materially to thickness of the stand.

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The Use of Soil Sampling Tubes

By Zenas Beers

Middle West Soil Improvement Committee, Chicago, Illinois

MANY crop growers have never seen their soils more than "skin deep." They know only the plow layer, and that only when the ground is turned over in the spring or fall. Some get a look at their subsoils when drain tiles are laid, after erosion has skinned off the topsoil, or when the plow has been set "too deep."

Yet crops use more than the plow layer to make high yields. Plow soles, hardpans, claypans, and otherwise tight layers in and below plow depth often limit yields and make plowing and cultivation more difficult and costly.

How to get quick and accurate information on the conditions below the plow layer at any time of the growing season has always been a problem. With the new soil sampling tubes * used by G. N. Hoffer these subsoil secrets can be quickly detected.

* Manufactured and sold by the Oliver Corp., 400 West Madison St., Chicago 6, Ill.

The object is to get an undisturbed section of soil at least 12 to 14 inches deep—the length of the soil sampler. The tube should be pushed straight into the soil without twisting or turning, and pulled straight out again. The "knee action" develops more power. With it the tube can be forced full length into most soils—those without gravel, rocks, shale, or other interferences. And, if the tube is slid against the closed side when pulled from the ground, the core will be in decent shape for shaving.

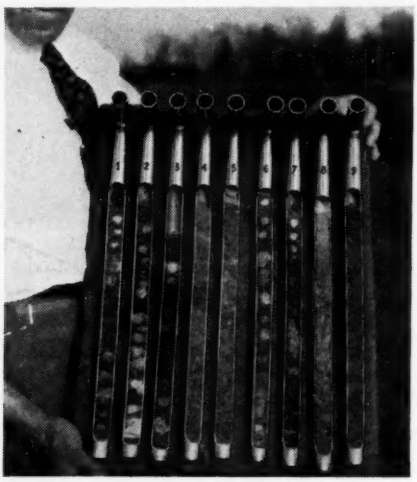
The soil core is chaffed or smeared when the tube is pulled from the soil. To get a true picture, the core must be carefully shaved or picked with a knife. Hold the thumb at the top of the core and shave from the bottom upwards. Take it in short sections, a little at a time, to keep from packing the cut surface of the core.

Comparison of cores is made easier if the sampling tubes are laid on a draw-

ing board, piece of plywood, or other board of similar size. Bore holes at one end of the board large enough to take the handle of the tubes. The holes in the board in the picture are 1⅛ inches in diameter and 1½ inches from center to center.

The white spots on Tubes 1, 2, 3, 6, and 7 show tight layers of soil. Tubes 4, 5, 8, and 9 were not tested for compactions. They were used for soil acidity tests at different levels and later for phosphate and potash tests. All sorts of comparative studies on the effects of liming, on the depth of topsoils, and the effect of various crops on tilth and structure can be made with these samplers.

To show clearly the differences in the

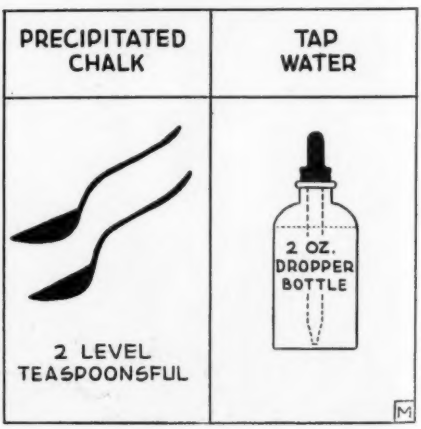


tilth between samples, Hoffer hit upon the idea of mixing chalk and water and then dropping the mixture on the surface of the soil in the tubes. Mellow soils (soils with good tilth), sandy soils, and silt loams will absorb both the water and the chalk. Tight clay soils or compacted zones in any of the soil samples will take the water but filter out the chalk. With the right mixture, one drop every inch from the top to the bottom of the core will be enough. With a thin mixture two or three drops may be needed to show the compacted layers.

The chalk to use is the U.S.P. Precipitated Chalk that can be bought in any drug store. Use two level teaspoonfuls of chalk to two ounces of water to start. Tap water will do. The bottle is an ordinary dropper bottle. If the mixture is too thick for some wet soils, pour out half the contents of the bottle and add as much water. *Always shake the bottle before using.* The important thing is to see how the chalk enters the samples tested as compared to samples of known good tilth. Relatively dry soils are better than wet ones for this study.

To have some standard for studying the soils in any field, pull a sample from a nearby fence-row or similar spot of

(*Turn to page* 39)



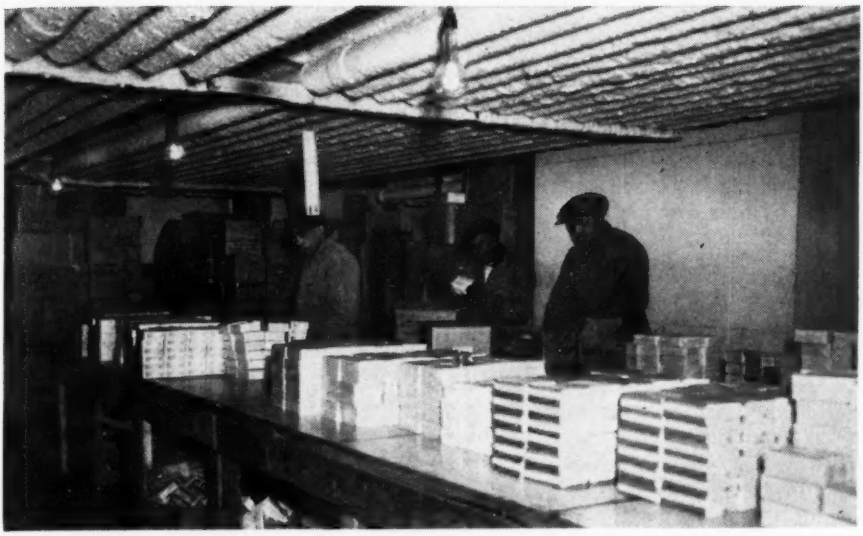


Fig. 1. Retail orders for frozen food are assembled in a room with temperature held below zero.

Handling Refrigerated Foods

By C. B. Sherman

Bureau of Agricultural Economics, U. S. Department of Agriculture, Washington, D. C.

THE frozen-food industry fairly shot into action, allowing little time for planning the way. Now the working out of improved methods of handling these frozen foods is one of the newer developments in this comparatively new field. Although frozen foods are still regarded by many as specialty items, their statistics are impressive, and crop growers have real reason to be interested in them, and in further possibilities.

In a single year the sales value of frozen foods has reached at least 300 million dollars. About 730 processors of frozen foods are marketing their products under more than 500 brands. This is done through about 1,200 wholesale distributors and 35,000 retailers.

This new industry offers considerable promise for reducing the cost of moving commodities from the farms to consumers—an inevitably large item in a country as large as ours. It also can expand the outlets for our farmers by giving a more even geographic and year-round distribution to the products from many of their crops. Consumers benefit by this better distribution in both time and place, and they evidently like the goods. So, in the light of these potential benefits to several groups, the U. S. Department of Agriculture is aiding in the study of better or best ways to handle frozen foods.

To get the maximum results from this new method it is not enough even to freeze and pack the right quality and the right quantity of the crops at

the right cost, a recent report points out. The quality must be maintained throughout the distribution channel by correct handling, and the expense of this handling must be kept low enough to allow mass distribution.

Refrigerator Cars

Beginning at the shipping point, shippers need refrigerator cars that can transport frozen foods at zero temperatures. The Department has successfully experimented with a new method of refrigerating railroad cars that has provided zero temperatures within the car for 10 days while the outside temperature was maintained at 90 degrees. More work must be done before this much-needed method can be put into common use but a promising start has been made.

Then, in conjunction with a committee of representatives of the food industries, the railroads, and private refrigerator car lines, the Department is trying to find out the best type of multiple-use car for protecting perishables in transit against both heat and cold. Now cars that include most of the improvements suggested by this committee are being constructed by the companies. They will soon be tested in actual use.

At the Warehouses

Meantime, the handling of frozen foods in the warehouses is under scrutiny in the hope of making advances. In some warehouses the facilities are inadequate for the best protection of the foods. Wartime conditions have been hard on both the buildings and their equipment at the same time that the frozen-food industry has been growing so rapidly. Then this new form has meant a pronounced change in the kind of business the operators of refrigerated warehouses are now called on to do, and in the services now expected of them. Because of the war there are only a few new warehouses, of course, and little new equipment. Time for taking inventory as to progress has had to be snatched from more pressing matters, so the expansion of the frozen-food business will be wanting improvements as the industry grows in the years ahead.

Facts Are Few

Warehousemen are recognizing the need for going into these matters now that materials and labor are becoming available. New equipment will be installed in proportion to the assurance the warehousemen and others in the industry have as to the possibilities and prospects of their future business especially in the newer phases—as with frozen foods. Others will want to enter the frozen-food business if it shows signs of continued growth. The Department of Agriculture has begun studies that will help in learning the possibilities of developing further markets for frozen foods. Some of the trends in distribution for each of the major frozen-food products are being analyzed and the results should soon be known.

Obviously, all the changes made and all the new equipment and new building should be designed for the most efficient storing and handling of these foods. Many questions are received by the Department of Agriculture as to general best lay-outs, and details, from men who want to know before they go ahead.

Findings on the Way

How best to plan, construct, and operate these facilities for handling frozen foods are the crucial questions. Positive answers are practically unknown as yet. Studies are underway which should yield practical answers to be given to all who are concerned with frozen food facilities. They should aid in the appraisal of present facilities and in planning expansions and new undertakings. Prospects are that these findings will be in keen demand, for there is tremendous interest in the frozen food industry.

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Fig. 1. A 5-year-old multiflora rose hedge fence supporting the weight of a 200-pound man standing on the frame of a stepladder placed on top of the hedge near the center. Midway Orchards, University of Missouri.

A Living Rose Fence

By T. J. Talbert

College of Agriculture, University of Missouri, Columbia, Missouri

A LIVING multiflora rose fence for practically all purposes and at low cost is now available. Such a fence is rugged, of long life, has few faults, and is surprisingly well adapted to nearly all sections of the country. In good soil and under proper culture it also can be produced in 2 or 3 years. It is economical, an effective barrier for livestock, an aid to soil conservation, and is now being used successfully by farmers. In general, the plant is considered new to most sections of the country. It is the hardy understock, however, upon which many of the garden roses are grafted or budded. The name "Multiflora" means many-flowered. Originally the plant came from Asia.

This Asiatic rose is effective against soil erosion, soil blowing, and snow drifting. It also has a place as a screen across gullies, irregular soil surfaces, and for fencing terrace outlets. The washing away and erosion of ditch and pond banks may be prevented through its proper use. The fibrous root system of the plant tends to make it valuable for use as a contour fence. Close spacing of the plants in setting generally increases their effectiveness for such purposes.

The fence is comparatively easy to establish. Yet it is not difficult to

eradicate. The plants do not spread from the planting site by roots, seeds, or suckers arising from underground rootstocks. Root growth is generally downward and there is no material extension laterally. The rose does not offer competition to nearby crops and its shade has not proved damaging to cultivated crops. It grows to a height of about 8 feet and to a spread of 7 or 8 feet in about three years. In later years these dimensions in growth do not appear to change materially. New canes grow up and the old ones die. The mass of canes with thorns, therefore, tends to increase in density and become more impenetrable each year without noticeable growth extension.

As a cover for quail and other forms of wildlife it is of great value. This is especially true in prairie regions, bottom lands, and where there are few or no permanent winter harbors. It may also serve to an advantage as an enclosure for wildlife areas. The rose is colorful in flowers, foliage, and fruit, and its shape and form render it valuable for use in beautifying both the home grounds and the farmstead. The bountiful seed crop of a reddish brown in color supplies a dependable source of food for many different kinds of birds during the winter season.

The land for the planting strip should be approximately 8 to 10 feet wide. It may be prepared by back-furrowing and then bed-furrowing followed by disking. As a barrier against all classes of livestock the plants are set 6 inches apart. For horses and cattle alone 12-inch spacing will prove adequate. A few commercial nurserymen are handling plants for sale. The rose is so new for farm purposes, however, that the demands may be greater than available supplies. In Missouri, the Conservation Commission at Jefferson City is endeavoring to supply the needs of producers. The rose may be propagated from both seeds and cuttings, and some growers have been very successful. Early spring or late fall plantings have given the best results. The plants are placed in a furrow made on the slight ridge in the center of the cultivated planting strip.

In the first experimental investigations the plants were spaced 3 or 4 feet

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Courtesy Steavenson, SCS, Elsberry, Mo.

Fig. 2. Multiflora rose fence planted on the contour and used as an enclosure for lambs.

Applying Soil Conservation Through Local Contract

By Arvy Carnes

Soil Conservation Service, Spartanburg, South Carolina

OPPORTUNITY in the form of soil conservation practice application is knocking on the doors of agricultural contractors located in soil conservation districts in the Southeastern States. For a veteran or any other person who desires to establish a contract business, soil conservation is a fertile field to investigate. In many communities, power and machinery on local farms are inadequate to establish rapidly the practices generally provided in soil conservation plans.

The use of machinery speeds and usually reduces the cost of establishing a number of conservation practices. These include farm ponds, terraces, pasture clearing and grubbing, drainage ditches, seed harvesting, lime and fertilizer spreading, tile drainage, hole digging for fence posts, land preparation, firebreaks, farm logging, gully filling, and land leveling. Several of these practices may be established with hand tools, but the cost is excessive as compared with power machine methods.

Soil and water conservation have made much progress during the last few years. Farmer-organized, farmer-operated soil conservation districts including all land in farms have been organized for entire states of Alabama and South Carolina; 96 per cent of Georgia; 93 per cent of Mississippi; 87 per cent of North Carolina; 85 per cent of Virginia; 71 per cent of Kentucky; 62 per cent of Florida; and 32 per cent of Tennessee.

Certain soil conservation practices that have been planned in soil conservation districts, but not applied, are summarized in Table I by states, as of January 1, 1948. This summary shows the great amount of work now ready to be applied throughout the region. Such jobs can be done by contract.

Dirt moving is only a part of the soil

TABLE I.—PRACTICES PLANNED AND READY TO BE APPLIED

State	Terraces (miles)	Pasture Improvement (Acres)	Farm Drainage (Acres)	Group Drainage (Acres)	Farm Ponds (Number)
Alabama	55,900	290,345	16,329	5,071	544
Florida	11,106	678,011	508,853	196,644	164
Georgia	118,724	518,248	57,417	0	1,478
Kentucky	17,220	328,257	48,455	10,312	3,284
Mississippi	73,379	462,559	230,917	33,819	1,485
North Carolina	42,660	130,461	83,040	118,716	497
South Carolina	32,464	137,363	77,455	26,072	265
Tennessee	24,595	150,197	36,024	10,364	553
Virginia	5,586	252,683	18,863	20,024	513
Region	381,634	2,948,124	1,077,353	421,022	8,783

conservation job open to agricultural contractors.

Vegetation is important in the soil conservation work on every farm. This means that great quantities of seed and plants will be needed. Machinery is required for efficient operations in harvesting seed of sericea, annual lespedezas, small grain, crotalaria, clovers, blue lupine, and for the digging of kudzu crowns.

To get the most cover from vegetation and thus the most soil conservation and soil improvement benefits, fertilizers and lime are needed on most Southeastern soils. Distribution of these materials is being done by contract in many soil conservation districts. Lime, potash, or phosphate, or a combination of them, will be used in developing a large part of the 2,948,124 acres of planned but not yet improved pasture shown in Table I.

The income of many farmers will not enable them to own all the machines necessary for the establishment of these and other soil conservation measures; in fact, on the average small farm there is not enough need for some heavy equipment to justify its purchase, regardless of the income of the farm owner.

Here, then, is the opportunity for the contractor to establish these soil conservation measures. Many soil conservation district supervisors believe that local contractors working closely with the soil conservation districts will help to speed the establishment of soil conservation practices. It is recognized, of course, that the supervisors do not have authority to obligate work for the contractor; however, the district supervisors may arrange for some training of the contractor who does not have experience in soil conservation work.

Soil conservation districts are set up under state laws and provide an ideal organization through which a contractor may work. In the vicinity of New Albany, Mississippi, before soil conservation districts were active, no draglines were owned by local people. Many farmers had field drainage jobs requiring draglines. Individual landowners had at times asked out-of-state dragline owners for estimates of the cost of the work to be done on their land. Each estimate given was based on the individual job, which made the cost prohibitive. After the Tallahatchie River Soil Conservation District had planned many farms in this area, the district governing body requested local Soil Conservation Service technicians to summarize the jobs in this vicinity, giving the location and size of each job. A contractor was asked to bid on the total work in a community. His unit price was reasonable and a dragline started work. Since that time, eight draglines have started on the same basis in counties near New Albany. The landowners and the contractor both benefit by such an organization. The farmer can get the work done at a reasonable price and the contractor has the work lined up ahead for continuous operations.

The Haywood County Soil Conservation District of Tennessee purchased several pieces of equipment for soil conservation practice application after sufficient farms had been planned to provide a year's work for the equipment. The supervisors sold the equipment to a contractor and entered into an agreement as to price for various jobs and the standards that would be followed. After one year's operation, the work was satisfactory and three other contractors wanted to start operations in the same county.

Each soil conservation district has a work plan which gives the specifications for the various soil conservation measures. The district supervisors would encourage farmers to employ contractors whose work meets these specifications.

Persons contemplating local contract work in soil conservation operations should:

1. Request the soil conservation district supervisors to summarize the planned practices, giving kind and vol-

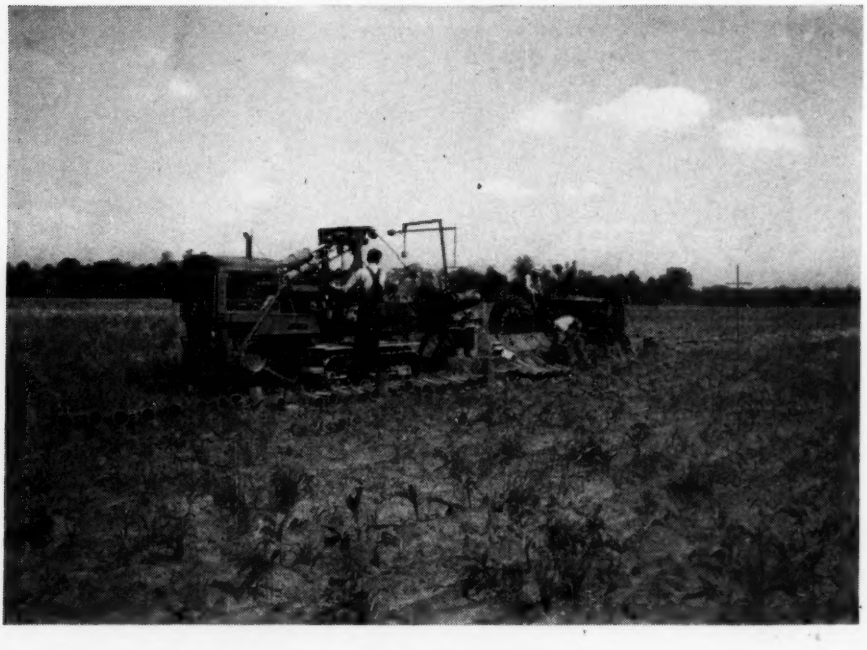
(*Turn to page* 41)

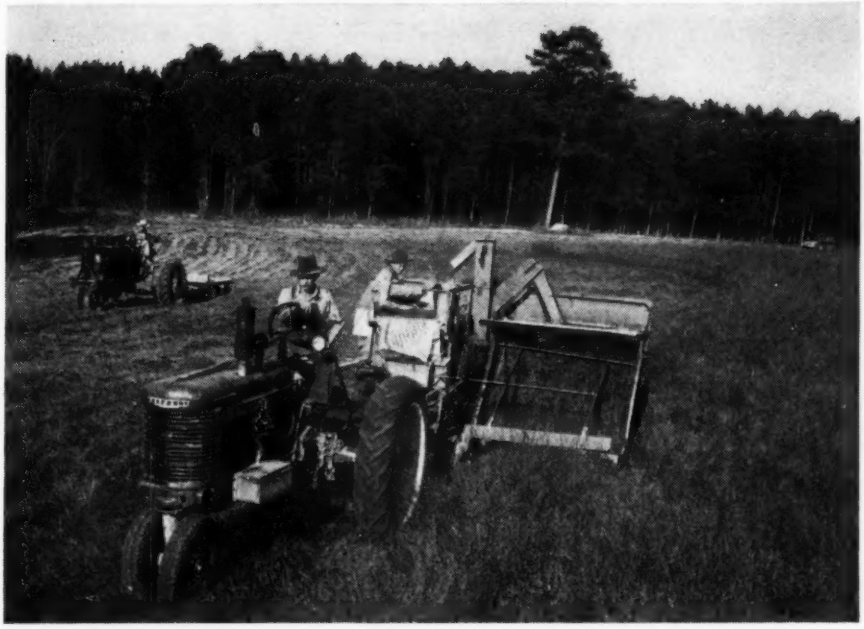
Above: **Building a farm pond. Many thousand such ponds will be needed in the Southeastern region; 8,783 have been planned. Carry-all scrapers are ideal equipment for pond construction.**

Below: **Much needed drainage has been planned for more than a million acres by dragline and other methods.**

Above: **Many pastures need clearing and grubbing as a part of the improvement work. The work can be done efficiently by using a clearing machine.**

Below: **Thousands of acres need tile drainage. A tile-trenching machine can do the work fast and economically.**





Above: **Millions of acres need annual lespedeza in crop rotations. Seed harvesting is a job that can be done by contract.**

Below: **Farm equipment can play a big part in terrace construction. The step-in method is being used here with tractor and disk-tiller.**

Above: **381,634 miles of terraces have been planned on farms in the 9 Southeastern States. The job is so large that it will take every available means to get it done in a reasonable time.**

Below: **Approximately 3,000,000 acres of pasture improvement are under way. Many of these acres need lime and fertilizer. A contractor with good equipment often can spread them more economically than farmers can.**

The Editors Talk

Diagnostic Techniques for Soils and Crops

Since the beginning of agricultural chemistry, one of the chief problems has been the determination of the nutrient needs of soils and crops. Tremendous progress has been made, and during recent decades of research by agricultural scientists working in the diagnostic field, many new methods have been devised to aid farmers in fertilizing their crops more effectively. In a new book, "DIAGNOSTIC TECHNIQUES FOR SOILS AND CROPS," just off the press, are to be found discussions of these diagnostic approaches with appraisals of their value and use.

Not too many years ago, diagnostic techniques were confined principally to soil tests. In the majority of cases these were restricted to the determination of soil acidity as a measure of lime requirements. In some few states, upon request, tests would also be made to determine available phosphorus and potassium. Various methods for accomplishing the latter, made known as developed, were advocated by as many soil chemists, and differences of opinion as to their value arose.

This situation led to the conviction that soil tests as the basis for fertilizer recommendations to be of maximum value to the farmer should be brought under the supervision of trained soil chemists whose findings could be interpreted from both the chemical and the agronomic viewpoint. This, in turn, called for the establishment of soil-testing laboratories under official supervision where both the results of the tests and the fertilizer recommendations based thereon could become official, expert, and unbiased by any viewpoint other than that which was best for the crop being grown under the conditions specified. In addition to the many such laboratories privately owned, the establishment of state soil-testing services has spread from the original 10 in 1935 to in excess of 25 states and (Canadian) provinces in 1948. Concurrently, the tests have been elaborated from the original three determinations of P and K among the plant foods and the so-called pH, which is a measure of soil acidity and lime requirements, to include in addition tests for nitrogen, magnesium, boron, manganese, copper, organic matter, and that important soil characteristic, base-exchange capacity, a measure of a soil's ability to retain plant foods in a non-leachable form yet one in which it is still available for crop use.

At the same time, as an important supplement to soil testing, emphasis was given to the plant-food content of the crop itself through chemical tests of the plant sap. These were called tissue tests and constituted a closer approach to the actual nutritional status of the crop. They verified the validity of the soil test, or if not, called for an examination of the crop-soil relations to determine why plant food if present in the soil in what appeared to be adequate amounts was not being utilized by the crop. The value of the tissue tests in their various forms has been widely recognized, resulting in their official adoption as collateral to soil testing in diagnosing crop-plant-food requirements.

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Tissue tests in their simpler and more convenient forms are largely qualitative in character. A natural development has been their reduction to the quantitative basis, designated as "leaf analysis" whereby the plant-food content of the crop under study can be accurately determined.

Along with the development of these techniques, likewise consistent effort has been brought to bear on the wider recognition of the various plant-food deficiency symptoms as displayed by the crops themselves, by the shape and color of leaves (foliar symptoms), abnormal plant growth and behavior, and quality of the products yielded. The culmination of this work was its recognition by the American Society of Agronomy, leading to the publication by the Society and the National Fertilizer Association of that excellent book, "Hunger Signs in Crops."

With an apparent need for a book discussing the development and value of these diagnostic techniques—soil testing, tissue tests, and the identification of leaf symptoms—from the viewpoint of underlying principles rather than details on specific methods, the American Potash Institute asked the following outstanding and widely known soil scientists to contribute chapters: Dr. Firman E. Bear, Chairman, Soils Department, New Jersey Agricultural Experiment Station and Editor of Soil Science; Dr. Michael Peech, Professor of Soil Science, Cornell University; Dr. Roger H. Bray, Professor of Soil Fertility, Illinois Agricultural Experiment Station; Dr. Ivan E. Miles, formerly Director of Soil-testing Division, North Carolina Department of Agriculture, now Leader of Extension Agronomy and in Charge of Soil Testing, Mississippi Extension Service; Dr. J. Fielding Reed, Director of Soil Testing, North Carolina Department of Agriculture and Research Professor in Agronomy, North Carolina State College; Dr. Jackson B. Hester, Soil Technologist, Department of Agricultural Research, Campbell Soup Company; Dr. Bert A. Krantz, Soil Scientist, Division of Soil Management and Irrigation, U. S. Department of Agriculture; Dr. Werner L. Nelson, Professor of Agronomy, North Carolina Agricultural Experiment Station; Dr. Leland F. Burkhart, formerly Assistant Professor in Agronomy, North Carolina Agricultural Experiment Station, now member of the Horticultural Department, Arizona Agricultural Experiment Station; Dr. Albert Ulrich, Assistant Plant Physiologist, Division of Plant Nutrition, University of California; Dr. S. C. Vandecaveye, Professor of Soils, State College of Washington; and Dr. J. E. McMurtrey, Jr., Principal Physiologist, Division of Tobacco, Medicinal, and Special Crops, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

The book is 7¼″ x 10¼″, is bound in durable green cloth, contains 332 pages of text and illustrations which include 5 color plates, 36 halftones, and 26 drawings. It is specially priced at $2.00 per copy, postpaid, and can be purchased through the Institute as per the advertisement toward the back of this issue.

"THE year that is drawing toward its close has been filled with the blessings of fruitful fields and healthful skies. To these bounties, which are so constantly enjoyed that we are prone to forget the source from which they come, others have been added, which are of so extraordinary a nature that they cannot fail to penetrate and soften the heart which is habitually insensible to the ever-watchful providence of Almighty God.

"Needful diversions of wealth and of strength from the fields of peaceful industry to the national defense have not arrested the plow, the shuttle or the ship. Population has steadily increased, notwithstanding the waste that has been made in the camp, the siege, and the battlefield; and the country, rejoicing in the consciousness of augmented strength and vigor, is permitted to expect continuance of years with large increase of freedom.

"No human counsel hath devised, nor hath any mortal hand worked out these great things. They are the gracious gifts of the Most High God, who, while dealing with us in anger for our sins, hath nevertheless remembered mercy." . . .

Abraham Lincoln on Thanksgiving

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1923.....	28.7	19.0	92.5	120.6	82.5	92.6	13.08	41.23	....
1924.....	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925.....	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926.....	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927.....	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941.....	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942.....	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945.....	21.2	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	28.3	38.2	124.0	219.0	156.0	191.0	17.30	71.40	....
1947									
November....	31.87	40.0	166.0	195.0	219.0	274.0	17.30	89.10	....
December....	34.06	46.9	172.0	204.0	237.0	279.0	18.10	94.80	....
1948									
January.....	33.14	45.9	186.0	217.0	246.0	281.0	18.70	95.10	....
February.....	30.71	38.5	193.0	231.0	192.0	212.0	19.60	88.60	....
March.....	31.77	29.6	196.0	237.0	211.0	221.0	19.70	87.90	....
April.....	34.10	31.2	209.0	240.0	219.0	229.0	19.40	89.40	....
May.....	35.27	40.1	196.0	244.0	216.0	222.0	18.30	90.70	....
June.....	35.22	41.7	187.0	246.0	216.0	211.0	17.90	92.20	....
July.....	32.99	43.6	166.0	262.0	202.0	203.0	18.20	96.00	....
August.....	30 41	47.4	158 0	265.0	191.0	196.0	17 80	76.60	.. .
September...	30.94	46.7	153.0	232.0	178.0	197.0	18.00	68.10	.
October.....	31.07	50.6	142.0	207.0	138.0	198.0	18.40	63.70	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1923.....	231	190	133	137	129	105	110	183	....
1924.....	185	190	98	170	166	141	107	147	143
1925.....	158	168	245	188	109	163	108	140	143
1926.....	101	179	189	134	116	138	112	98	139
1927.....	163	207	146	124	132	135	87	154	127
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	93	81	109	74	87	110
1938.....	69	196	80	83	76	64	57	97	88
1939.....	73	154	100	85	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	107	117	107	81	211	129
1942.....	153	369	168	136	143	124	91	202	163
1943.....	160	405	188	232	174	154	125	231	245
1944.....	167	420	214	219	170	160	138	234	212
1945.....	171	366	205	232	198	170	127	227	224
1946.....	228	382	178	249	212	209	146	317	204
1947									
November....	257	400	238	222	341	310	146	395	272
December....	275	469	247	232	369	316	152	420	294
1948									
January.....	267	459	267	247	383	318	158	422	320
February.....	248	385	277	263	299	240	165	393	320
March.....	256	296	281	270	329	250	166	390	295
April.....	275	312	300	273	341	259	163	396	340
May.....	284	401	281	278	336	251	154	402	262
June.....	284	417	268	280	336	239	151	409	213
July.....	266	436	238	298	315	230	153	428	213
August.....	245	474	227	302	298	222	150	340	172
September...	250	467	220	264	277	223	152	302	150
October.....	251	506	204	236	215	224	155	282	176

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947						
November	2.66	1.78	14.22	11.06	12.75	11.53
December	2.71	1.78	15.98	11.71	12.75	12.81
1948						
January	2.78	1.83	16.22	11.71	12.75	13.28
February	2.78	1.90	15.03	12.15	12.75	12.60
March	2.78	1.90	13.68	12.06	12.75	9.47
April	2.78	1.90	13.87	11.71	12.75	8.35
May	2.78	1.90	13.77	9.54	12.75	7.89
June	2.78	1.90	14.69	9.11	8.23	8.24
July	2.78	2.07	14.56	9.22	8.80	8.73
August	2.91	2.10	10.91	9.76	8.92	8.98
September	3.00	2.20	10.70	9.87	9.18	9.03
October	3.00	2.20	9.31	9.98	9.42	9.48

Index Numbers (1910-14 = 100)

1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947						
November	99	62	406	313	378	328
December	101	62	457	332	378	364
1948						
January	104	64	463	332	378	377
February	104	67	429	344	378	358
March	104	67	391	342	378	269
April	104	67	396	332	378	237
May	104	67	393	270	378	224
June	104	67	420	258	244	234
July	104	73	416	261	261	248
August	109	74	312	276	265	255
September	112	77	306	280	272	257
October	112	77	266	283	279	269

Wholesale Prices of Phosphates and Potash **

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5 50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367[1]
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947							
November	.760	3.42	6.60	.375	.669	14.50	.200
December	.760	3.42	6.60	.375	.669	14.50	.200
1948							
January	.760	3.42	6.60	.375	.669	14.50	.200
February	.760	3.42	6.60	.375	.669	14.50	.200
March	.760	3.42	6.60	.375	.669	14.50	.200
April	.760	4.11	6.60	.375	.669	14.50	.200
May	.760	4.61	6.60	.375	.669	14.50	.200
June	.760	4.61	6.60	.330[1]	.634	12.76[1]	.176
July	.770	4.61	6.60	.353	.676	13.63	.188
August	.770	4.61	6.60	.353	.678	13.63	.188
September	.770	4.61	6.60	.353	.678	13.63	.188
October	.763	4.61	6.60	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947							
November	142	95	135	68	70	60	83
December	142	95	135	68	70	60	83
1948							
January	142	95	135	68	70	60	83
February	142	95	135	68	70	60	83
March	142	95	135	68	70	60	83
April	142	114	135	68	70	60	83
May	142	128	135	68	70	60	83
June	142	128	135	62	67	53	80
July	144	128	135	65	71	56	82
August	144	128	135	65	71	56	82
September	144	128	135	65	71	56	82
October	142	128	135	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924.....	143	152	143	103	97	125	94	79
1925.....	156	156	151	112	100	131	109	80
1926.....	146	155	146	119	94	135	112	86
1927.....	142	153	139	116	89	150	100	94
1928.....	151	155	141	121	87	177	108	97
1929.....	149	154	139	114	79	146	114	97
1930.....	128	146	126	105	72	131	101	99
1931.....	90	126	107	83	62	83	90	99
1932.....	68	108	95	71	46	48	85	99
1933.....	72	108	96	70	45	71	81	95
1934.....	90	122	109	72	47	90	91	72
1935.....	109	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	122	131	126	81	50	129	95	75
1938.....	97	123	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	131	127	86	56	130	102	77
1942.....	159	152	144	93	57	161	112	77
1943.....	192	167	151	94	57	160	117	77
1944.....	195	176	152	96	57	174	120	76
1945.....	202	180	154	97	57	175	121	76
1946.....	233	203	177	107	62	240	125	75
1947								
November.	287	257	231	135	80	380	142	71
December..	301	262	236	138	81	400	142	71
1948								
January...	307	266	242	139	83	403	142	71
February..	279	263	233	139	85	393	142	71
March.....	283	262	233	137	85	379	142	71
April.....	291	264	238	137	85	380	142	71
May.....	289	265	239	137	85	370	142	71
June.....	295	266	241	128	85	309	142	65
July.....	301	266	247	131	88	317	144	68
August....	293	266	247	129	91	285	144	68
September.	290	265	247	131	94	287	144	68
October...	277	263	241	130	94	277	142	72

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash are lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Fertilizer Sales, by Grades, 1947-1948 Season," State Dept. of Agr. & Ind., Montgomery, Ala., 48-48.

"Rice Fertilizer Experiments, 1938-45," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul., 477, May 1948, L. C. Kapp.

"Sales of Commercial Fertilizers and of Agricultural Minerals Reported to Date for Quarter Ended June 30, 1948," Bu. of Chem., State Dept. of Agr., Sacramento 14, Calif., FM-168, Aug. 25, 1948.

"Commercial Fertilizers Registrants to Date for the Fiscal Year Ending June 30, 1949," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., FM-169, Aug. 26, 1948.

"Agricultural Minerals Registrants to Date for the Fiscal Year Ending June 30, 1949," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., FM-170, Aug. 27, 1948.

"Auxiliary Plant Chemicals Registrants to Date for the Fiscal Year Ending June 30, 1949," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., FM-171, Aug. 30, 1948.

"Regulations for Sampling Fertilizing Materials," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., FM-172, Sept. 21, 1948.

"Fertilizers Act—amendments to the Regulations under the Act," Extract from the CANADA GAZETTE (Part II) of Wednesday, July 28, 1948, Ottawa, Canada.

"Ammonia as a Source of Nitrogen," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 451, Feb. 1948, W. B. Andrews, F. E. Edwards, and J. G. Hammons.

"Corn Fertilization in the Yazoo-Mississippi Delta," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 454, May 1948, P. H. Grissom.

"Fertilizer Recommendations for Mississippi, 1948," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 136, Jan. 1948, Russell Coleman.

"Fertilizer Sales in Ohio—January 1 to June 30, 1948," Dept. of Agron., Ohio State Univ., Columbus, Ohio.

"Fertilizer Sales in Oklahoma by Analyses—July 1, 1947 to June 30, 1948," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla.

"Summary of Fertilizer and Fertilizer Materials Sold in South Carolina, 1947-48," Dept. of Fert. Insp. and Analysis, Clemson Agr. College, Clemson, S. C., Aug. 13, 1948.

"Fertilizer Tonnage Used in Tennessee During Fiscal Year Ending June 30, 1948," State Dept. of Agr., Nashville 3, Tenn.

"Increasing Oat Yields with Topdressing of Nitrogen," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1118, April 20, 1948, E. B. Reynolds and J. C. Smith.

"Distribution of Fertilizer Sales in Texas, January 1—June 30, 1948," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1130, Aug. 10, 1948, J. F. Fudge.

Soils

"Drainage Reclamations in the Bartholomew-Boeuf-Tensas Basin of Arkansas and Louisiana," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 476, April 1948, R. W. Harrison and W. M. Kollmorgen.

"Orchard Soil Management," Stat. and Pub. Branch, Dept. of Agr., Toronto, Ont., Can., Bul. 457, Jan. 1948, E. F. Palmer and J. R. Van Haarlem.

"Fertility Status of Delaware Soils," Agr. Exp. Sta., Univ. of Del., Newark, Del., Bul. 269, Nov. 1947, G. M. Gilligan and C. E. Phillips.

"Influence of Soil Management Practices on Tree Growth and Leaf and Soil Analysis in a Young Peach Orchard," Agr. Exp. Sta., Univ. of Del., Newark, Del., Cir. 21, Nov. 1947, A. L. Kenworthy and G. M. Gilligan.

"Soil Management and Fertilizers for Indiana Fruit Crops," Purdue Ext. Serv., Lafayette, Ind., Ext. Leaflet 185 (Third Rev.), 1947.

"Crop Production Under Irrigation in Nebraska," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., Ext. Cir. 180, April 1948, D. L. Gross.

"Crop Rotations Under Irrigation," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., E. C. 182, May 1948, D. L. Gross.

"Oklahoma Summary by Soil Conservation Districts of Work for 1947," State Soil Conservation Board, Oklahoma City, Oklahoma.

"Water Input Use for Field Crops at the United States Scotts Bluff (Nebr.) Field Station, 1941-44," U. S. D. A., Washington, D. C., Cir. 777, July 1948, C. S. Scofield and O. W. Howe.

"Soil Survey—Johnson County, Indiana,"

Agr. Research Admin., U. S. D. A., Washington, D. C., Series 1938, No. 13, Issued May 1948, H. P. Ulrich, T. E. Barnes, A. P. Bell, Sutton Myers, T. E. Nivison, P. T. Veale, and A. T. Wiancko.

"Soil Survey, Transylvania County, North Carolina," Agr. Research Admin., U. S. D. A., Washington, D. C., Series 1938, No. 17, Issued June 1948, S. O. Perkins, William Gettys, E. F. Goldston, and C. W. Croom.

"Soil Survey—Tazewell County, Virginia," Agr. Research Admin., U. S. D. A., Washington, D. C., Series 1938, No. 18, Issued May 1948, H. C. Porter, E. F. Henry, K. M. Oliver, D. D. Mason, G. C. Price, P. B. Douglas, R. C. Jurney, and Ralph G. Leighty.

Crops

"Handbook of Alabama Agriculture," (Fourth Ed.), Ext. Serv., Ala. Polytechnic Inst., Auburn, Ala., 1947.

"How to Establish Stands of Crimson Clover —Sericea Combination for Grazing in the Tennessee Valley," Agr. Exp. Sta., Ala. Polytechnic Inst., Auburn, Ala., P. R. Series No. 40, May 1948, Fred Stewart.

"Lawns for Arizona," Agr. Ext. Serv., Univ. of Ariz., Tucson, Ariz., Cir. 135, March 1948, Steve Fazio.

"Cotton Variety Tests, 1941-1945," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 475, March 1948, D. B. Shank.

"Increasing Yields of Oats in Arkansas," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 479, June 1948, R. P. Bartholomew.

"Ruby Cabernet and Emerald Riesling, Two New Table-Wine Grape Varieties," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 704, May 1948, H. P. Olmo.

"Perlette and Delight—Two New Early Maturing Seedless Table Grape Varieties," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 705, May 1948, H. P. Olmo.

"Scarlet, A New Grape Variety for Fresh Juice and Jellies," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 706, May 1948, H. P. Olmo.

"Orchard Soil Management and Apple Nutrition in Eastern Canada," Div. of Hort., Exp. Farms Serv., Dom. Dept. of Agr., Ottawa, Ont., Can., Publ. 802, March 1948, M. B. Davis and H. Hill.

"Construction and Management of Tobacco Seed-Beds," Tobacco Div., Central Exp. Farm, Ottawa, Ont., Can., Publ. 806, Issued Aug. 1948, E. T. McEvoy.

"Soybeans," Dominion Dept. of Agr., Ottawa, Ont., Can., Publ. 807, Issued June 1948, (Rev. Farmers' Bul. 80), F. Dimmock.

"Report of the Minister of Agriculture, Province of Ontario, for the Year Ending March 31st, 1946," Toronto, Ont., Can., 1946.

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"Twenty-sixth Annual Report of the Canadian Plant Disease Survey, 1946," Dominion Dept. of Agr., Div. of Botany and Plant Pathology, Ottawa, Ont., Can., 1947.

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"Thirtieth Annual Report," State Dept. of Agr., Springfield, Ill., 1947.

"Evaluation of Winter Wheat Varieties for Illinois," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 625, May 1948, J. F. Rundquist, G. H. Dungan, O. T. Bonnett, and Benjamin Koehler.

"Report on Agricultural Research for the Year Ending June 30, 1947," Agr. Exp. Sta., Iowa State College, Ames, Iowa.

"Evergreen Windbreaks for Iowa Farmsteads," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Bul. P88, May 1948, R. B. Campbell and R. B. Grau.

"Tobacco Stalks, Hemp Hurds, and Sorghum Bagasse as Sources of Cellulose for Making High-Quality Paper," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 515, March 1948, E. B. Lewis, D. G. Card, and J. S. McHargue.

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"Australian Canner, a New Sweetpotato Variety," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sheet 403, Feb. 1948, W. S. Anderson and C. E. Steinbauer.

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"Forage Production and Grain Saving on Your Farm," Gen. Ext. Serv., Univ. of N. H., Durham, N. H., Cir. 287, Feb. 1948.

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Economics

"Part-time Farming in New England," Ext. Service, Univ. of Conn., Storrs, Conn., Bul. 383, Oct. 1947.

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"Effect of Improved Land Husbandry on Income and Organization of Rolling-land Farms," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 516, April 1948, G. B. Byers and W. G. Survant.

"Plan of Work, Extension Service, 1948," Rutgers Univ., New Brunswick, N. J.

"Suggested Plan for the Large Southern Piedmont Cotton Farms," Univ. of N. C., Raleigh, N. C., Ext. Cir. 321, July 1948, C. B. Ratchford.

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"Agricultural Statistics 1947," U.S.D.A., Washington 25, D. C.

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Use of Soil Sampling Tubes

(*From page* 20)

known good tilth. Then take samples at regular intervals across the field and compare them with the fence-row sample and with each other for depth of topsoil, organic matter, color differences, plow soles, claypans, hardpans, soil aggregates, and other conditions.

Many growers will be surprised to learn how little topsoil they have. Others will find that a plow sole makes their fields shallow by keeping the fibrous roots of corn and small grains "upstairs." Such a plow sole is evident in Figure 3, Tube 6. Others will find the conditions evident in Figure 3, Tube 2, where drain tile will be effective.

Samples from corn fields, good and bad, taken and studied by Hoffer last year showed the need for greater use of tilth-building crops. The study confirmed other experimental conclusions that the choice of legumes for use in a rotation designed to give the highest possible yields over a period of years should be based on both the yields of forage and the tilth-building ability of the legumes. And where structure is a real problem, the use of legumes that build structure more quickly and permanently should be given serious consideration even though their forage yields may be lower than that of other legumes.

Alfalfa and sweet clover appear to be the best tilth-builders among the legumes, Hoffer suggests. They act more quickly than others. They act through a thicker layer of soil. On those soils that are adapted to their growth and where tilth is a problem, growers may well profit from altering their present rotations to include these legumes.

As with every diagnostic procedure the value of the soil samples will depend on the experience and judgment

of the taker. The best use of the soil sampler is made when the crops are inspected and tested along with the soil. The chalk, soils, and plant tissue tests will give valuable information on soil tilth and plant nutrient needs for planning rotations and crop fertilization practices. Some studies of this kind have already been reported in an article by G. N. Hoffer, "Soil Aeration and Crop Responses to Fertilizers—1947," in the December 1947 issue of BETTER CROPS WITH PLANT FOOD.

Better Hay with Potash

(*From page* 8)

was 3.79 tons with an average content of 57 per cent legumes. Two other plots 118 and 119, also received 100 pounds of potash per acre but the average yields were only 2.95 and 2.50 tons per acre respectively. Two reasons for the lower average yields on these two plots seem probable. Plot 114 had received its potash in the form of kainit for many years previous to the change in plans for the experiment. It is possible that beneficial residual minor elements supplied by this source may account for the higher yields in the subsequent years. On the other hand, plot 119 had received much higher potash applications than 114 in previous years and in the form of sulfate of potash. Considerably heavier yields of all crops grown resulted. On this plot it is possible that the heavier crops had depleted the soil of certain essential minor elements which it will be necessary to add in the fertilizer before full benefits will be realized from present fertilizer applications. Plot 118 had received a medium application of double manure salts previously. It also may be lacking in some minor elements.

On plots 115 and 117 where only 50 pounds of potash per acre were applied annually, the yields were reduced to 1.82 and 1.44 tons per acre respectively. The average legume content of the hay was only 3 per cent.

These results show the necessity for supplying an ample amount of potash in the fertilizer in order to maintain stands of legumes in a legume-grass mixture. In the seeding on these plots, clovers had practically all disappeared after the second season. Alfalfa was the only legume remaining for the 3 last years of the test. This too had nearly disappeared on all plots except those receiving 100 pounds of K_2O per acre.

The three accompanying photographs taken in July 1944 just previous to the second cutting that year show the amount of alfalfa remaining on plots

TABLE II.—THE EFFECT OF VARYING AMOUNTS OF POTASH ON THE YIELD AND AVERAGE ESTIMATED COMPOSITION OF LEGUME-GRASS HAY, 1941-1945, INCLUSIVE.

Plot	Treatment N–P_2O_5–K_2O	Yield in Tons per Acre+						Average Per Cent	
		1941	1942	1943	1944	1945	Average	Legumes	Grasses
118	20–80–100 M*	3.62	2.46	3.21	2.27	3.20	2.95	49	51
114	20–80–100 S**	3.75	5.58	3.51	2.62	3.47	3.79	57	43
119	20–80–100 S	3.56	3.01	1.94	1.56	2.42	2.50	35	65
115	20–80– 50 M	3.24	2.66	1.28	0.79	1.11	1.82	3	97
117	20–80– 50 S	2.35	2.08	1.19	0.67	0.93	1.44	3	97
116	20–80– 25 M	2.11	1.82	0.79	0.54	0.61	1.17	2	98

+ 15% Moisture basis.
* Muriate of potash.
** Sulfate of potash.

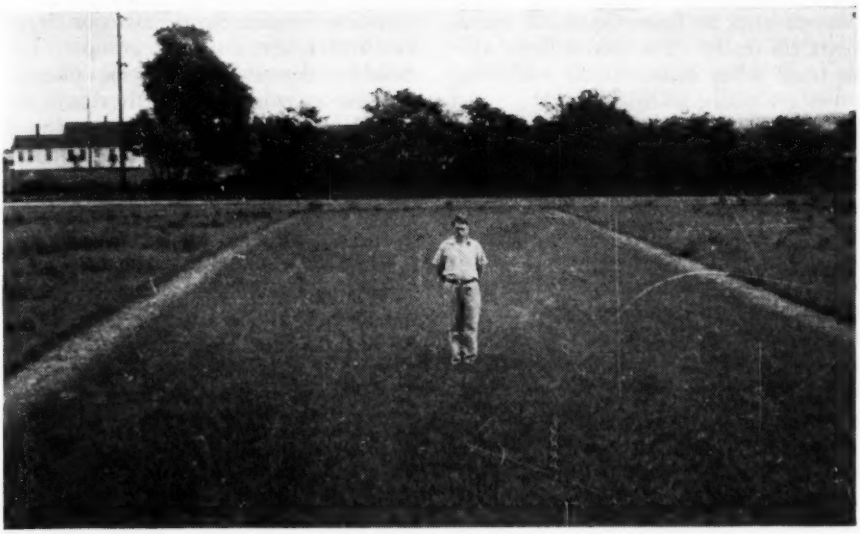

Fig. 3. Plot 116, July 17, 1944. Fertilizer 20 pounds N, 80 pounds P_2O_5, and 25 pounds K_2O annually. No legumes.

receiving 100, 50, and 25 pounds of potash annually. There is a good stand of alfalfa on the plot receiving 100 pounds of potash, a few scattered plants on the 50-pound plot and none on the 25-pound plot.

A 3-ton crop of alfalfa removes 135 pounds of K_2O per acre annually. A certain amount of this can be taken from the residual potash in the soil. The remainder must be supplied by fertilizer. From these experiments it seems clear that at least 100 pounds per acre of K_2O in the fertilizer will be needed under local conditions to maintain alfalfa in a legume-grass mixture. This agrees with the conclusion reached by Munsell of the Connecticut Station who recommends that 200 pounds of 60 per cent muriate of potash should be applied annually to supply the potash needs of alfalfa under their conditions.

The dairyman who is looking for a method of saving grain by improving the yields and quality of his hay crop should consider the possibility of growing more alfalfa and maintaining the stands of this valuable grain saver through the use of ample potash fertilizer.

Applying Soil Conservation . . . Contract

(*From page* 26)

ume of such practices on various localities.

2. In collaboration with the soil conservation district supervisors, agree on a fair price per unit for each practice.

3. Determine that at least approximately one year's work would be available.

4. Determine whether the district supervisors will let the contractor operate district-owned equipment on some plan agreed upon.

5. Understand the district supervisors' specifications for various practices and agree to do the work accordingly. It is believed that the contractor, who is skilled in the operation of equipment but not familiar with the establishment of soil conservation practices, should operate the first equipment unit

himself until he learns to do all operations efficiently. He then will be able to train other operators, if additional units are added to his business.

The contractor will have his own ideas about the proper type of equipment to be used. It should be kept in mind there is a relatively large amount of moving from farm to farm that requires mobile equipment. Terraces may be constructed efficiently with farm tractors and disk plows, disk tillers, moldboard plows, or small blades. Some contractors prefer heavy crawler-type tractors and blade graders and some use road patrols for terracing. For constructing earth dams and ditches, the conventional types of grading and excavating equipment generally are used.

In our experience, one of the most difficult problems to solve in installing conservation measures is obtaining proper equipment. The soil conservation districts recognize this problem, and many of them have procured machines for rental to cooperating farmers. Experience indicates that one or two years' operation with district equipment is often necessary before a work load that is attractive to contractors is developed.

The contractor in the soil conservation field will come in contact with soil conservation districts and, through them, with representatives of the U. S. Department of Agriculture's Soil Conservation Service, State Extension Service, and other assisting groups. He should understand the functions of each of these agencies, because they have assigned responsibility for planning and supervising soil and water conservation work.

My advice to prospective contractors in the soil conservation field is to select a work location in a soil conservation district where sufficient demonstration has been made to assure a good work load among interested farmers. It will be found that these farmers already have decided to install conservation practices and that the work has been planned. Become acquainted with the district governing body and local agricultural workers and assure them of your interest in soil and water conservation by performing good work in accordance with their program.

Select adaptable equipment which can be moved inexpensively from job to job. Learn about conservation needs and about the functions and limitations of the structures you propose to build. Finally, do good work at a fair price. If these conditions are observed, contractors will be welcomed by district supervisors in many soil conservation districts throughout the Southeastern Region. We expect a much greater expansion of the program throughout the next few years. It is going to take plenty of work out on farms.

A Living Rose Fence

(*From page* 24)

apart for a single-row barrier. More recently plantings have been made with plants one foot apart to turn horses and cattle, and 6 inches apart as a barrier against hogs, sheep, and goats. This closer spacing seems much more certain of achieving results in terms of a tight barrier at the earliest possible date. Furthermore, the multiflora rose cannot be expected to make a dense, vigorous growth where overtopped by trees; hence barrier plantings around woodlots or trees should be at least 20 feet from large trees for satisfactory growth.

The multiflora rose responds markedly to liberal mulching (straw, spoiled hay, old stack butts, etc.). Cultivation the first year or two is likewise beneficial, but cultivation is not necessary where liberal mulching suppresses grass and weed competition. Mulch-

ing has generally proven more stimulating than cultivation, especially where there is danger of soil erosion on sloping land. If a single row of roses is used as a field divider, adjacent farm operations, consisting of tillage or mowing, are helpful in reducing weed and grass competition. If supplemented with mulching the need for cultivation is eliminated.

The use of fertilizers seems much less important than good soil preparation, timeliness and thoroughness in planting, proper mulching, adequate irrigation the first year, and good cultivation. This is true because the response to fertilizers has been varied and sometimes negative.

A fall application of 2 to 4 inches of manure spread over the planting site should generally prove satisfactory. Also the manure may be supplemented to advantage through the use of a complete fertilizer. This fertilizer may be placed on the manure or mixed with it at the time of spreading at the rate of about 160 to 200 pounds for each one-fourth mile.

Thorough disking should follow the fertilizer application. Then the planting site should be plowed as deeply as soil conditions permit and a slight ridge left in the center of the cultivated belt to facilitate soil drainage.

On the experimental grounds, College of Agriculture at Columbia, under conditions of fairly good soil and culture, a good barrier against horses, cattle, sheep, and hogs was developed in two years. On tight, poor, or droughty soils a longer period may be required to produce satisfactory fences, especially for hogs, sheep, and goats. Under good growing conditions, however, with the plants spaced 6 inches apart, effective fences against all livestock should be produced in 2 to 3 years.

Unlike the Osage Orange, the multiflora rose is a shrub and not a tree; hence it will occupy much less ground. It has the signal advantage of requiring no trimming to keep it in bounds. Its initial vigor, particularly on the poorer soils, will greatly surpass that of Osage. For barrier effect, especially in separating cultivated fields from pastures or in fencing out terrace outlets and the like, the plants should be given good culture. This may consist chiefly of cultivation or mulching, and fertilization may be necessary to provide a uniformly vigorous and dense barrier.

Handling Refrigerated Foods

(*From page* 22)

Meanwhile the regular monthly cold storage reports, issued by the Department, show the total amount of occupied and unoccupied refrigerated space, and the holding of each commodity. The coverage for this space now comprises about 1,800 concerns. State laws regarding activities of cold-storage warehouses are compiled and summarized, and now a directory of all the refrigerated warehouses that make reports to the Department has been issued. It indicates indirectly where warehouse facilities are plentiful and where they are short.

Those Lockers

Frozen-food locker plants have come on speedily as we all know. They have increased quickly in both number and size. Perhaps 10 years ago we first began to hear of them. At last count there were 9,700 plants serving about 3 million families, and the average number of individual food lockers per plant is larger now. There is a better distribution of the commercial plants throughout the country than formerly, but the greatest numbers are still found in the Midwest and at points along the Pacific Coast. More plants of this

kind are needed in the South, the investigators point out, where local supplies of meat and fresh fruits and vegetables are available for freezing. They would increase the market outlets for varied products grown in the place of the ubiquitous cotton, and they should contribute successfully to the nutritional values in the diet of that region.

Many small towns that are remote from refrigerated warehouses have asked for specifications and recommendations or suggestions regarding such an enterprise. Therefore, disinterested and research consideration of this phase of storage may come next, in direct answer to demand.

Home freezers are a subject in themselves. Many consumers will testify to the revolution in their food programs brought about by freezer lockers whether commercial or installed in their own homes. Nutrition specialists and home demonstration agents report generally that a prevailing request during last year was for information about preparing food for freezer lockers.

Refrigerated Consumer Packages

In connection with studies of livestock and meat markets the recent report has a good deal to say about consumer packages and their possibilities.

"Changes in the methods of processing and distributing meats are given increased attention by some of the larger meat packers and chain retail stores. Packers are experimenting with new cutting procedures at the packing plants, wherein carcass meat is being cut, trimmed, boned, and wrapped in consumer-sized packages. The consumer cuts are expected to be offered for sale either in fresh or in frozen form, but in either case each package will be stamped as to the kind of cut, quality, grade, weight, and price. Chain stores are looking forward to offering consumer cuts of meat to the public on a self-serve basis just as soon as packers make meat available in this form, and the necessary freezer cabinets become available for use at the retail level.

"It is thought that meats can be processed into consumer-sized packages at the packing plant and handled in the channels of trade more economically than is now possible under present methods. This method of handling meats deviates from the method of han-

Fig. 2. Battery-type self-service frozen food cabinet for retailers that can be restocked from the frozen reserve stored at the bottom of the cabinet.

dling them by freezer locker plants in that the meats are offered for sale at the retail level. Since the locker plant method has proved to be so popular in rural communities, it is to be expected that consumer-sized packages of meat in the fresh or frozen form will prove to be popular in retail markets."

As resources permit, the Department of Agriculture plans to study the best ways of handling frozen products after they have reached the wholesale markets and again after they are in retail markets where they finally are set before the customers who buy them for the tables. These frozen foods must be handled advisedly at every stage of marketing if the best results for a long-time industry of benefit to growers, consumers, and the intermediaries are to prevail.

More and more, food researchers are convinced that refrigeration is the word that unlocks real promise for the future, in the way of reduced costs, reduced wastes, better quality for consumers, and more general availability of nutritional foods—all of which seem to spell a happy outcome for those better crops of today and tomorrow.

Crop Logging Sugar Cane

(*From page* 18)

The second surface application (the third actual) of another 50 to 60 pounds of N is made at 4 to 5 months of age when the crop is about ready to "close in" and is the last time fertilizer can be applied by hand.

In other words, about 140 to 150 pounds of nitrogen are applied on irrigated fields before the crop is 6 months old. This quantity, about ¾ of the total amount to be applied, is applied on a routine basis. Such a procedure is highly desirable for it enables the plantation Agriculturist to plan ahead for the fertilizer required and for the field men to develop smooth work plans.

Exceptions to this practice are determined by the crop log. In fields, irrigated with mill or waste water containing nitrogen, where the N index remains very high, the two surface applications of fertilizers may be reduced in amount, or the second application may be canceled. Also, occasionally, fields with very shallow soil or with soils which pack badly will show a low N index with the application made, in which case an additional application is made. We have learned from experience that unless we maintain a high nitrogen level in the crop during this first six months, efficiency in irrigation is low. The final application of nitrogen will be described later.

Irrigation. The first irrigation water to a newly planted field is, of course, applied as soon as possible after planting. Because the germination seed piece requires warmth and oxygen as well as moisture, it is desirable to irrigate as infrequently as possible. When inspection shows the soil around the seed piece to be only slightly darkened by moisture, the next irrigation is applied. Obviously, excessive irrigation at this stage is harmful, since it keeps the soil cold and improperly aerated. It is better in this phase to err on the side of drought. Irrigation by inspection is continued until germination is complete. Following the application of fertilizer (see above) irrigation is placed on a schedule. Some plantations have worked out a schedule based simply on so many days for each season of the year, and for the stage of crop. Some have used soil moisture determinations, and some now are using the tensiometer to great advantage. Sugar cane, for full growth,

requires a soil moisture content which never approaches the wilting point.

If all these practices are conducted with precision, the first samples from the field will show moisture index high, the nitrogen index high, K and P indices normal, and the primary index low. When these things obtain, the crop is making excellent progress. Vigor is high and growth is strong.

Weeding. Where weeds are allowed to grow, even though all the practices outlined above are carried out, the progress of the crop is blocked. Usually the primary index will be very high, moisture low. It is essential to maintain control of weeds. The practices for these first six months will, of course, favor weed growth as well as cane growth. However, if weeding operations are properly timed, control is eventually simpler because the crop closes in earlier and takes care of itself sooner.

As the crop log develops during this early period, its chief function is checking on the crop's progress. If the moisture index is not properly maintained, irrigation performance is checked into. Sometimes the water is not kept in the line long enough. Sometimes the lines are too steep, etc. If the N index is excessively high or low, adjustments are made. If the K index is low, an application is made.

The Crop from 6 to 17 Months. During this period most of the stalk growth is made. It is necessary to keep the crop active. To accomplish this, irrigation is maintained so as to keep the moisture index at as high a level as possible. During the period from 6 to 10 or 12 months it normally will decline to perhaps 80 or 81. Also the growth made is sufficiently great so that the cane lodges. Where the crops are very heavy (well over 100 tons at harvest), a midcrop ripening is imposed, usually when the crop is between 10 to 12 months of age. This is accomplished by withholding irrigation until the moisture index reaches 77 or 78. A general hardening of the cane stalks results, along with a deposition of sugar. At the conclusion of this treatment, or at about 12 months on those fields where the midcrop ripening is not imposed, the final application of nitrogen is made. To be sure, should the nitrogen level drop below critical levels (see below), the final application may be made earlier. The amount of the final application is arrived at through calculation. As shown on page 17, the crop up until this stage had received 125 pounds of nitrogen and was 10 months of age. The simple mathematical proportion is set up:

$$\frac{\text{applied \#N}}{\text{Actual months of age}} \quad \text{as} \quad \frac{\text{X \#N}}{\text{remaining months of age}}$$

The answer to the proportion so far as the crop shown on page 17 is 175 pounds. If the nitrogen applied were completely used up, this amount would be applied. The nitrogen index is consulted. If the level is at 1.25 per cent, we have learned that essentially all the nitrogen is used up. Also, we have learned that at Waipio, where this crop was grown, a nitrogen index of 1.65 indicates adequate nitrogen. That is, if the index is at 1.65 or above at 12 months of age, no further application would be made. In the present case, however, the nitrogen level is at 1.45 at 10 months, which we interpret to mean that one-half of the nitrogen called for by the proportion above will actually be added. It will be noted that with the application of the 85 pounds N and with resumption of full irrigation, both the moisture index and the nitrogen index rise and full growth is restored. The log serves as a running check on the growth being made

and therefore on operations affecting this growth.

The final portion of the crop is given over to ripening and preparing it for harvest, and will be discussed in the next section.

The Crop Log as Source Material for Initiation of New Practices

The ripening of sugar cane on irrigated plantations presents one of the most difficult of crop-management operations. Various rule-of-thumb procedures have been used and although at times some plantations have enjoyed remarkable success, at other times they have experienced difficulties.

After the crop logging program had been in operation a while, so that complete histories of crops were on record for objective examination, a study of these logs was undertaken with particular reference to crop ripening. As a result, a method was developed which one plantation used with signal success last year, and which four plantations are using in varying degrees this year.

The crop log study revealed that in general the quality of normal crops is directly related to their moisture content, not only at harvest time but also throughout the second season of growth. On this basis, crops during the second season may be classified as being at high, intermediate, or low moisture levels. Those crops at a high moisture level may be ripened satisfactorily but require a much longer period than the other two. On the other hand, the low moisture crops may be ripened excessively and thereby have their quality ruined if treated the same way as the high moisture crop. As a result of these observations a ripening program has been developed which is promising continued improvement.

At seven months before harvest, all crops are automatically brought up for consideration by field management. The crop logs are consulted and the crop classified. Sheath samples are gathered from each of the ripening fields on a weekly or biweekly schedule, depending on the heat intensity of the area.

Those crops which are classed as high moisture crops immediately are placed on the ripening schedule. This involves suspension of irrigation until the moisture index reaches a certain value. For example, if the moisture index is 82, it may be decided not to irrigate until it reaches 79. When 79 is reached an irrigation is applied, and a new level is set for the next round, perhaps 76, etc. This is continued so that at harvest time the moisture index is about 73. Experience has shown that a high level moisture crop can be ripened successfully if the stages are gradual. If they are not gradual, definite injury is done the crop. Also, if crops are dried out below 73, dead cane begins to appear in the field.

Those crops which are classed as intermediate moisture level crops are continued on normal irrigation schedules until the moisture level intersects a time line. They are then placed on ripening with lower initial moisture levels before another irrigation is applied, but with the same level, 73, desired at harvest time.

Those crops which are classed as low moisture level crops are kept on the normal irrigation level much longer than either of the above types, but again are harvested when they reach the 73 level.

The advantages of this method are in general two: Crops are ripened according to their need for ripening; crops not requiring prolonged ripening are continued in their normal growth cycle for a longer time, thus adding to their yield possibilities.

The Crop Log as a Record of Long-time Trends

Since the crop log is an intimate portrayal of crops as they grow, it can be used to advantage to show trends in a series of successive crops on the same field. One illustration will suffice. On one plantation potash fertili-

zation had been difficult because some crops seemed to show a response while others did not. Crop logs revealed two facts not fully appreciated before. One was that in the area successive ratoons had an increasing need for potash and the other that crops irrigated with mountain water had a much greater need for added potash than those receiving pump water.

Conclusion

The crop log has emphasized the need for balancing and fitting a crop to its environment. It has shown that the moisture level of a crop is dominant in accomplishing this. It dictates the time of fertilizer application and it predicts the quantity of fertilizer applied. It seems that the crop log gives the grower an objective means of continuing improvement of crop production.

It will be obvious to the reader that the broad principles, as outlined, will apply to any crop, but that many of the applications will vary with the crop. Some short-lived crops would be less amenable to change once they have been started. Long-lived crops, particularly perennial crops, are best suited, and hence should profit most from a crop log program.

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Ladino Clover—Italian Gift

(*From page* 10)

gether, but since Dallis grass is spring seeded, it leaves much to be desired as a companion grass for Ladino clover.

More recently tall fescue has shown promise as a Ladino clover associate, and experiments are now under way in which this combination will be evaluated. The low palatability rating usually given to tall fescue farther north does not seem to apply here. It is at least as palatable as Dallis grass. Others have considered tall fescue too aggressive. However, since in some experiments at the North Carolina Station we have had some difficulty maintaining orchard grass in Ladino clover, the aggressiveness of tall fescue may be an advantage under our conditions.

Ladino clover was grown experimentally in North Carolina in the middle thirties but because of mismanagement was not at first successful. We learned the hard way that it must not be grazed in the same manner as white clover or lespedeza, and must be fertilized more liberally. Experiments are now in progress at this institution in which seeding mixtures of (a) Ladino clover-orchard grass (b) Ladino clover-tall fescue, and (c) orchard-redtop-white clover-lespedeza are being grazed with dairy heifers under four systems of pasture management. These systems consist of (1) continuous-moderate grazing, (2) rotational-moderate, (3) rotational—with the peak growth be-

Fig. 3. Left: Carpet grass pasture. Right: Carpet grass pasture that has been renovated with Ladino clover produced total digestible nutrients equivalent to 72 bushels of corn in 1947. Coastal Plain Experiment Station, Willard, N. C.

ing converted into hay, and (4) rotational-heavy grazing.

Ladino pastures have the advantage of being used for hay or silage during seasons of lush growth. Since Ladino maintains a succulent type of growth over a long growing period it is an excellent grazing crop not only for dairy and beef cattle but also for poultry and hogs.

Two pounds of this new clover seeded with 12 pounds of orchard or 10 pounds of tall fescue will produce for the North Carolina dairyman the best pasture he ever had, provided it is adequately fertilized and properly managed.

Mamma and Mammon

(*From page* 5)

that no industry boasts as many full-time workers as the home does today. Besides this class of professional stay-at-home housekeepers, the country has a growing number of ladies who work for daily wages. This group takes in both the bona fide mothers with growing children and the others who either can't or won't have such nuisances to cope with.

Census figures reveal that in 1900 there were about 330 full-time homemakers for every 100 females in the labor force. By 1945 the ratio had declined to 155 to 100. I anticipate that if the cost of living keeps right on soaring we can count on a 50-50 balance between those who are able to stay at home all the time and those who are obliged to be Mammon-chasing Mammas.

Oh, of course, we can still have Thanksgiving dinners all right. By dint of a little advance monetary calculation and select choice of commercial cafeterias we can reserve a family table

and celebrate away from home. In 1945 it was estimated by some wise-acres that sales of food in eating places had risen to about $50 for every $100 of sales in retail food emporiums. Naturally, that wave of unrest and abandonment of the home dining-room has not really taken firm hold as yet out where the crops begin. Farmers have the money to pay for plenty of boughten victuals in restaurants, but the real down-to-earth secret reason for their reluctance to indulge in the practice is that the individual servings at lunchrooms are too skimpy. You can't get that bloated feeling reading a high-priced menu.

I AM not predicting anything about what may happen in the open country. In due time some of the habits of homemakers now so general in towns may creep out into the rural areas. It could happen. In some degree it has already happened.

Farm women used to stuff mattresses, churn butter, and set the broody hens. Nowdays they buy their bed-rests, go to the co-op for their butter, and patronize the hatchery for their chicks. Yet I do not suppose we can call it "emancipation." It's just evolution, and fairly sound common sense besides.

However, before we pass the rural housekeeper entirely, let's jot down the truth that she is an outdoor worker as well as a cook and a darner. Reliable "surveys" (and what in tarnation would we do without them?) teach us that in 1947 fully 10 per cent of all agricultural workers in winter and up to 20 per cent of them in summertime were women over 15 years old. The growth of power farming has by no means cut down the zest and interest which manual labor and outdoor exertion bear for the feminine worker. Hence the city homemaker who feels that she is misused because of doing double duty in and outside the home can find a counterpart in her country cousin.

When it comes to dirt-chasing proclivities and necessities, I presume that the story is about even Steven between country Mammas and urban Matrons. Everybody who has resided in the so-called clean and clear open countryside knows full well that an accumulation of original dirt and acquired dust can settle around the premises pronto. Men-folks are always traipsing inwards with utter disregard of the niceties. Towels can get even grimier and grittier among arable acres than in some urban environments. The friendly poultry escape to clutter the rear porch and drop untidy things for harried housewives to eradicate. Power machinery can stir up more dust on a dry, windy day than the gold-dust twins can swallow.

Even so, the lot of the lady in town is often no better. The truck routes and the bustle and swirl of life, the clouds of smoke and the litter of close living habits, all combine to give her a constant production job of no mean proportions. The homemaker as a sanitary engineer signifies an endless and often thankless job.

Despite the fact already noted that the homemaking army exceeds that of the biggest single industry, we haven't come to any sound conclusions as to what this work is worth, or what these "gals" really earn for themselves and society.

TO attempt any sound estimate would require more adding machines and bulging brains than we can command at this writing. It would seem clear, however, that what Mammas are worth in Mammon is somewhat dependent upon what you would have to pay for a darn good substitute. In saying this, of course, we hasten to explain that there is no possible substitute for a wife who runs the home for its own sweet sake. But still, if you had to go out and hire a gang of women to perform all the tasks which Mamma does in an average day, the

sum total would dent your bank balance no end.

I once read a guesstimate on this point that sounded reasonable. The writer averred that in order to replace one single full-time homemaker who amounted to anything, you would be obliged to spend hours angling in an agency to get four full-time specialists. The list would consist of a cook, a governess, a maid, and a gardener, according to his belief—and you'd pay at going wages about $10,000 for their valuable advice and personal services. (Plus any overtime rates.)

You might get by a bit cheaper in the farming sections. But out there you'd want to figure in a part-time field hand and an extra milker, in addition to what you'd pay for the aforesaid quartet of notables. On top of all this, and after you had presumably got it nicely settled, the baby would wake up with the bellyache—without any night nurse to be summoned after regular working hours.

SPEAKING of scarcities in getting the proper quality in homemaking skills, I think we ought to say a word about the girls who studied hard to be successful household craftsmen and never had any chance to demonstrate their ability in homes of their own—with kids.

It may be due to the price pressure of the present, but there are still too many young men who dawdle around and let these able women keep right on working in offices and stores, when they should throw a bridle on them and get into double harness. For every rank misfit found botching around some house trying to pretend she is a producer, there are a couple of dozen likely aspirants willing to shove the old job aside and wear aprons. I vow there is more real talent going to waste in America in the realm of household achievement than we can find in almost any profession. But if we persist in neglecting this field and forget what happens to a craft without good apprentices, we are in for some rude shocks.

MUCH can also be said for the women who do outside work in addition to homemaking. I've heard a good deal of criticism aimed at the brisk gals who hang onto their paying jobs after they join partners with some successful male. To often they are charged with being money-crazy, with being too anxious to keep on wearing extra-fine duds, and of being lazy and indifferent to dusting, baking, and dishwashing.

As long as these women are without children and have only two persons to care for, I'm not going to snub them. Maybe the days seem long and dreary staying close to the apartment, and if they have learned special skills and are looking ahead to a possible rainy day of adversity, it's sound business to keep in touch with the profession and keep in practice for such a contingency. Besides, it takes almost two ordinary urban earners to accumulate enough "sand" in one week to scour the establishment, with prices as they are today.

I ALSO sympathize fully with the other Mamma who sticks to the little old homestead, come Hades or high water. I had one of this brand for thirty years. There are plenty of times when such a Mamma would relish fine clothes and nicer furniture and prettier outfits for the kids than she can fashion at home. There are many anxious moments for these home-loving, all-around homemakers—times when Dad is not doing so well, when saving gets pretty irksome in the face of others who spend and have. She darns and stitches and roughens her hands and loses her complexion and her shape, but never her equipoise and forbearance and tolerance. She is of the type they spoke of with such charity and pride in the scriptures of old—the precious and loving Mother

of Israel. I place her at the head of the procession when it comes to showing off our Mammas. That is, if she has good enough clothes to let her stand inspection.

No, I have no predictions as to the future outlook in the realm of homemaking. All I am certain about is that we must have good homes or else we are bound to meet a fate worse than anything the "iron curtain" can disclose.

I am sure we are going to be provided with about as good a proportion of Mammas as the Past has given us. Whether that equal number of females will supply us with as good Mammas as we have boasted in our empire-building era is conjectural.

It will unless we go entirely "commercial." There has been a distinct trend that way in farm zones for years. It captured the city home economy long ago. Thus far it hasn't turned out so badly. We have found a way to enjoy a reasonable social and spiritual experience even under a faster and more material age.

OUR infant crop of recent years has been almost as phenomenal and as bountiful per acre as our fruits and cereals. This means that much more of my time and yours and that of the Mammas must be spent in child-rearing and twig-bending. To do this well will require that more time be supplied to the homemakers of America. Not that alone, but we must have more full-time devotion to things that you just can't measure in dollars and cents.

That's one reason we all hope so hard for a reasonable term of peace in the world. For while there are wars and rumors of wars afloat and family adjustments arising from wars staring us in the face, we won't be able to regain that balance and harmony wherein Mamma and Maternity can find a lasting strength and provide the comfort and security which humanity sorely needs.

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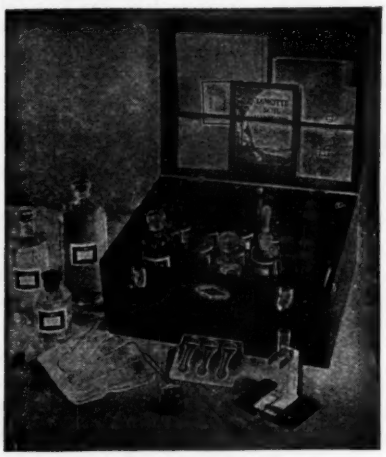

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Professor (sternly): "When the room settles down I will begin the lecture."

Student: "Why, don't you go home and sleep it off?"

* * *

Little Linda set out for Sunday services in her best bib and tucker, equipped with two shiny nickels—one for the collection plate and one for an ice cream cone on the way home. She scarcely had left the house when one of the coins slipped out of her fingers and rolled into a drain. "Gosh darn," said Linda. "There goes the Lord's nickel."

* * *

NO NEWS TO HIM

Nurse (to young man attempting to enter hospital nursey): "You can't go in there. You're not sterile."

Pappy: "You're telling me!"

* * *

Boss (pointing to a cigarette stub on the floor): "Is that yours, Johnny?"

Office Boy: "No sir. You saw it first."

* * *

The hunter was showing off his collection of trophies to a group of visitors. He was rapturously explaining how he had acquired the various exhibits.

"See that elephant?" he said. "I shot it in my pajamas."

"My goodness." murmured the surprised young lady, "how did it get there?"

GREEK

Teacher—"What are the three important Greek orders?"

Small Boy—"Cups skuffey, rroas bif sanwhich, and peas coconut pie."

* * *

Interested old lady, (Questioning model): "Do you mean to say that you pose for a man with no clothes on?"

Model: "Heavens, no! He wears pants and everything."

* * *

SAILOR, BE WARY

A sailor, just returned from a long cruise, rushed to a telephone and called his girl friend. In a few minutes he came out of the booth looking bewildered.

"She's gonna get married," he told a pal.

"Forget her," advised the pal. "There're lots of girls."

"Yeah," replied the sailor, "but she's gonna marry me."

* * *

A Negro couple applied for a marriage license.

Clerk: "Married before?"

Bride-to-Be: "Yessah."

Clerk: "Husband deceased or divorced?"

Bride-to-Be: "I deceased him."

* * *

She—"Do you like t'neck?"

Gob—"Naw. Me fer de drumstick."

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